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EDITORIAL NOTES—GAS, &c.

The Gaslight and Coke Company's Meeting—A Critic of Co-Partnership.

THE meeting of the proprietors of the Gaslight and Coke Company last Friday was one of the most important that has been held for some years. The resolutions that were passed—endorsing (in adopting the report) the action of the Board in respect of co-partnership, and agreeing with the Bill that has been introduced into Parliament—are the best evidences that the Governor (Mr. Corbet Woodall) and his colleagues can have of the confidence of their constituents, and of the ratification of their policy in broadening the work, objects, and constitution of the Company within legitimate limits, and in thus increasing the stability of the concern. Uniformity of the conditions of gas supply in the Metropolis is the latest aim; and an excellent one it is. Equality in the circumstances of the gas workers throughout London has been instituted; and completion of the equality of the standards applying to the staple commodity of the concerns is now within sight. The new conditions will, it is believed, inure to the further cheapening of the Company's product, and thus give them the means of overtaking some of the possibilities as to extended use lying before the industry. In the same direction is also found one of the ulterior objects of the planned amalgamation of the West Ham Company. The district will give the Gaslight Company an opening from their closely bordered area; and the economic results that must ensue from the fusion will be distributed in greater part to the consumers throughout the area. There is in the Company's position, politically and financially, every encouragement for the proprietors; and happily they recognize it, even though not very effusive in their recognition. Having examined the accounts in last week's issue, we will only emphasize by repetition here three points from the Governor's speech. One is that in five years the Company have reduced the price of gas by 3d. per 1000 cubic feet, and that (from Jan. 1 last) this 3d. represents a concession to the consumers of £200,000 per annum. The second point is that the lady demonstrators of the Company have to the present given personal instruction in the use of gas-cooking stoves in no less than 15,000 kitchens. And the third point is that the Governor stated that the Board had purchased a substantial proportion of the coal required for 1909-10 at a price considerably less than the average under the current contracts. The same may be said regarding the oil contract.

But the introduction of co-partnership by the Board was a—we might say, the—feature of the meeting; and another feature that hinged upon it was a brilliant example of rhetoric, having for its characteristics an absolute want of consecutive thought, the absence of the requisite intimacy with the subject to give the right to condemn, and an utter deficiency in knowledge of human nature. The speech was by Mr. A. M. Paddon. Whether intentional or not, to many who heard it the deliverance had an amount of unnecessary warmth about it; and if it had been delivered twenty years or so ago, it might have had a very detrimental effect just in those quarters where co-partnership is intended to, and (what is more) does, benefit. Mr. Paddon proclaimed his sympathy with the objectives of the scheme; but we did not gather from his speech that he knows what are its objectives. He projects his thoughts to the old-age stage of the worker, if the worker is fortunate enough to have an old age; and in his hurry to get to the (so to speak) ultimate stage of human life, he does not stay to give a thought to whether the scheme has any immediate and continuously existing objectives other than the one assisting in lightening the burden of the workers' final years. Co-partnership is a beneficial scheme for labour with a multiplicity of objectives, such as no other scheme that has yet been put forward has possessed; and he will be a clever man, and worthy of our highest esteem and gratitude, who can show one that is more comprehensive. Mr. Paddon sees danger in co-partnership—a danger that twenty years' working elsewhere proves is nothing but the product of incompetent judgment on this particular matter. He also finds that co-partnership has microscopic effects for the worker. From whence did Mr. Paddon view this subject? Evidently from the top of a mountain; and naturally the objects in the valley below looked diminutive. The observer may be advised to get to closer quarters; and he will find that to the workers benefiting under co-partnership the present effects are real and material. Mr. Paddon admits that he shares in the common human desire to possess; but he does not appear to entertain the slightest notion that the same desire can have existence in the workman, and can have the effect, as it has upon himself, of impelling to greater activity and to order actions in the effort to attain more. The toiler finds happiness in possession; and he believes, as firmly as anyone better circumstanced in life, that "a bird in the hand is worth two in the bush."

The gas workers of to-day who enjoy the advantages of co-partnership know far more of its effects than Mr. Paddon; and in their eyes his attack will be invested with some selfishness, accompanied by a desire to perpetuate the division of capital and labour, and to sequestrate labour from the enjoyment of the benefits provided by co-partnership that help to make up the sum of man's happiness. He would supplant co-partnership by a revision of the sick and pension funds, so as to make the benefits under them more substantial than they are at present. Those are benefits the worker may or may not enjoy. He will be lucky if he does not participate in the one, but does in the other. But these funds do not give the same pleasure, or offer the same inducements, or provide the same stimulus as present and accruing possession. The property or stock accumulation is not the only thing that co-partnership does for the worker, though the men of the South Metropolitan, the Commercial, the South Suburban, and other Gas Companies will want to know what manner of man is this who describes their thousands of pounds of invested capital and the ownership of not a few houses, all obtained through co-partnership, as microscopic effects. Let him get among the co-partnership workmen, and investigate the concurrent effects, and see whether his distant observation has not caused him to unfairly belittle them. He will find appreciative men—men whose intelligence has been quickened, whose interests have been widened, whose hopes have secured a stronger foundation. The present bonded interest, and knowledge of the continuance of that interest, between employer and employed, with the newly awakened concern in the larger affairs of life, have all had a distinctly elevating influence upon the lives, the work, and the homes of the men. This is the view of observers brought into immediate contact with the men; and it is our view, formed from opportunities for making personal investigation. It is not the view of the observer who deliberately keeps himself at a remote distance. Sick, pension, and other funds of the conventional type (excellent as they are) have not cured disaffection among labour, nor prevented industrial disputes; and the benefits which are suspended beyond individual possession until ill-health or old age overtakes may be fattened, but they will not have any better effect. Workmen are human just as much as the proprietor well-favoured in this world's goods.

Two other points, and we have done with this attack on co-partnership. Mr. Paddon has a fear at which experienced co-partners will smile. He thinks a voting power will by the scheme be transferred to the men out of all proportion to their investment in the Company. He does not think that co-partnership will kill the hatred of capital that was reflected in the resolution passed at the conference of the Labour Party at Portsmouth, which resolution reiterated

the doctrine that what is wanted in these times is "the "socialization of the means of production, distribution, and "exchange, controlled by a democratic State in the interests "of the entire community, with the complete emancipa- "tion of labour from the domination of capital and land- "lordism." To forward in a practical way the objects of this Socialistic teaching, Mr. Paddon seems to think, the voting power obtained under co-partnership may be employed. Our own opinion is diametrically opposed to this view. Any voting power that the workmen partners of the Company may secure will not be used in furtherance of the aims adumbrated in the resolution passed at Portsmouth, but in the protection of the capital that they amass under co-partnership; and in using their power to protect their own property, they will be protecting the property of their fellow proprietors. Imagine, if it can be imagined, the co-partners of the South Metropolitan Gas Company conspiring to vote in favour of the municipalization of the South London Gas-Works. There is not a man among them to-day who would care to part with his rights and benefits under co-partnership, as in all probability he would have to do if the works were transferred to municipal control.

Mr. Paddon's comparisons of the members of the Board of the Gaslight and Coke Company and of Sir George Livesey were not conceived in the most graceful or courteous spirit; but the only observation that need be made upon his remarks in connection therewith must be in the nature of a contradiction that co-partnership has not proved its success apart from Sir George. The pioneer of the movement himself was often heard to say that if he did not believe the system was one that would flourish after he was gone, he would be the first to abandon it. Unfortunately for Mr. Paddon's argument, fortunately for co-partnership, other Companies have shown its success separated from the personal influence of Sir George. There is the Commercial Company, for instance. Has there been any retrograde movement of co-partnership in the case of the concern since Sir George retired from the Board? The Chairman, Directors, officers, and men will, with one voice, aver to the contrary. It is not the least interesting reflection in connection with the extraordinary speech heard at Horseferry Road on Friday, that so many men of ability in commercial administration and with large experience in the management of men should have adopted the system, and that, after so many years' practical trial, it should have been left to Mr. Paddon to discover, or fancy he has discovered, their error. Mr. R. J. N. Neville, who has had considerable experience in the directorial work of a large gas undertaking, touched the real note of the feeling of the meeting when he said: "Sir George "has given us an example; let us follow him." This was endorsed by the Governor and by other proprietors; and there was no dissentient voice in the whole meeting other than that of Mr. Paddon. This gentleman has been floundering about in theory, while others have been ensuring in a practical way industrial peace, efficiency, contentment, and the general happiness of their employees.

Hygienic Advantage of Gas over Electric Lighting.

LAST week we referred to the conclusive demonstration which investigations of the latest types of gas-burners and electric lamps in Berlin have afforded of the economy of gas as compared with electricity for public and domestic lighting. It was shown by data derived from experiences gained by responsible officers of the Corporation of the City of Berlin that for public lighting current must be supplied at ¼d. per unit to compete, in respect of efficiency of illumination and cost, with gas supplied at 2s. per 1000 cubic feet. It was further shown that for domestic lighting gas at 2s. 6d. per 1000 cubic feet is cheaper than current at 1d. per unit, even when the high cost of renewals of the expensive metallic filament lamps is left out of consideration. These lamps cost anything from 3s. to 6s. apiece, and from two to three would certainly be required per annum for a lamp in regular domestic use—say, for 1800 lighting hours in the year. It will thus be fair to take the cost of renewals at 9s. per annum. Two to three inverted mantles would, on an average, be an ample allowance for renewals for the same number of burning hours. They cost from 4d. to 6d. apiece. Let us be liberal, and allow 3s. per annum for mantle maintenance, which is a rate at which gas companies undertake it for consumers. It can then be found by a simple calculation that the cost of mantle renewals is more than covered by an allowance of 6d. for every 1000 cubic feet of gas consumed for lighting purposes. That is to say, if gas is obtainable at 2s. 6d. per 1000 cubic feet, the total cost of lighting by inverted incandescent burners may be taken at 3s. The cost of renewals of the metallic filament electric lamps, similarly calculated in relation to the current used, amounts to something over ½d. for every unit of electricity consumed by them. But as 36½ units have been shown to be required in such lamps to afford illumination equivalent to that obtainable from 1000 cubic feet of gas, it will be readily seen that, taking into consideration renewals of lamps and mantles, current must be obtainable for domestic lighting at ½d. per unit to compete, in respect of efficiency of illumination and cost, with gas at 2s. 6d. per 1000 cubic feet. This is a plain statement of the relative expense of domestic lighting by the two agencies, which no parrot-like reiteration of the untruth "Electricity is cheaper than gas" can gainsay.

Let us now pass on to the hygienic question, as to which electricians often are, Professor Drehschmidt pointed out by an apt quotation, almost equally untruthful. According to the circular issued by the Hildesheim Electricity Works, "the vitiation of the air by a gas-burner is equiva- "lent to the presence of four persons, and gives rise to per- "manent injury to health. It is by no means easy to improve "by ventilation the air thus vitiated, for carbonic acid is "heavier and is only drawn off at the last." What are the facts? A cubic foot of gas on combustion yields approximately half a cubic foot of carbonic acid. A human being, except when sleeping, gives off about three-quarters of a cubic foot of carbonic acid per hour. That is to say, a "Bijou" inverted gas-burner, consuming 1 to 1¼ cubic feet per hour, produces less carbonic acid than one human being. But let us pause for a moment to see how exhaled air compares in other respects with the products of the combustion of gas.

In a recent number of the "Archiv für Hygiene," Herr W. Weichardt gave an account of some investigations which he had carried out on this point. In the air exhaled from the respiratory organs of human beings, he has found a high molecular poisonous product, of albuminous origin, of the character of a toxin. He gave it the name of "Renotoxin." It appears to be derived from matter expressed by the muscles when they are subject to fatigue. This discovery confirms, and affords an explanation of, Pettenkofer's observation that pure carbonic acid is far less injurious than the carbonic acid derived from respiration. Pettenkofer found that pure carbonic acid in the proportion of 100 parts per 10,000 parts of air was not injurious to human beings; while 10 parts of carbonic acid per 10,000, if derived from the respiration or perspiration of human beings, rendered the air unfit for a person to remain in it for any length of time. Recognizing this difference, Herr Weichardt points out that, in respect of harmfulness to the occupants, five incandescent gas-burners in a room are equivalent to one human being. These figures evidently refer to upturned incandescent burners. If modified to apply to the modern inverted burner, it may fairly be said that ten gas-burners in a room are not more harmful to the occupants than one adult person. Herr Weichardt goes on also to show that the gas-flames actually have a purifying influence, which electric lamps have not, on the atmosphere of rooms, by reason of their free combustion acting destructively upon the organic products of respiration.

We have availed ourselves of a German contemporary authority to refute the major untruth of the circular emanating from a German electricity works. The facts, so far as the hygienic quality of gas lighting by modern burners is concerned, are so broadly known that it can only be in sheer desperation that electricians pretend to deny them. They even parade their ignorance—or is it unscrupulousness?—by implying that carbonic acid is more difficult of removal by ventilation on account of its high density. It is well known to all who have had to study problems of ventilation that carbonic acid, whether produced by gas-flames or by respiratory processes, naturally rises in an occupied room, and so is readily removed therefrom. The proportion of carbonic acid is lowest in the air at the floor level, and gradually increases upwards to the ceiling, because it is evolved in a heated state and is forthwith mixed by diffusion with the upper strata of air. Thus a gas-burner, though it evolves a little carbonic acid, actually facilitates the natural ventilation of a room. Can as much be truthfully claimed for the electric lamp, despite its enormously greater cost of installation and running charges?

Responsibility for the Bermondsey Explosion.

THE inquiry by Dr. F. J. Waldo into the cause of the death of one of the little victims of the disastrous explosion in the Grange Road, Bermondsey, has at length ended. So far as a Coroner's Court can make an efficient tribunal for the solution of a matter involving such complicated issues and surrounded by so many technical considerations as in this case, there must be satisfaction with the whole proceedings, except on the point as to the manner in which the gas was ignited, and determination of which exonerates the South Metropolitan Gas Company from, or imposes on them, a share of the responsibility and consequent liability. The sequence of events that led up to the explosion, save the single point of ignition, is now quite clear. A broken water-main, the washing away of the loose sandy soil, the snapping of a rider gas-main through the removal of its support, and the presence of a large old disused sewer serving as a receptable for the disturbed soil and ultimately for the liberated gas, as well as affording facility for the distribution of the latter. The Jury, in the event, fixed upon the London County Council, the Metropolitan Water Board, and the South Metropolitan Gas Company jointly and severally the responsibility for the occurrence, which wrecked portions of the roadway, damaged certain of the property in the road, and caused the death of two children. The Jury appended to their verdict a rider to the effect that the Gas Company's employees were not guilty of criminal negligence.

On the point to which we take exception in the Jury's verdict—the cause of the ignition of the gas—the evidence as to whether the men employed lighted tarred rope or merely the electric hand-lamps with which they are provided for use in the case of gas escapes was most contradictory and indeterminate; and it will appear to most disinterested persons, who carefully weigh the evidence, that the Jury were a little too assertive in their opinion that the Gas Company's men did use lighted tarred rope, and that this was the cause of the ignition. Not only the workmen themselves, but reputable and independent witnesses declared that the former only used electric hand-lamps; while others whom we fully credit with faithfully stating their belief speak of open flames being employed. It is quite easy at a distance for a person to mistake an electric incandescent light for a naked light; and on the night of the explosions there were many lights about the scene of the disaster. The human eye and attention are not, as a rule, so concentrated on affairs occurring in a roadway on which men are at work that there can be positive assertion as to a detail on the part of passers-by. Even assuming, however, the Gas Company's men were—contrary to official instructions, and contrary to the intention attested by the carrying of electric hand-lamps—using lighted tarred rope, that fact alone would not be sufficient to definitely convict the means of lighting of being, though a possible one, the actual cause of ignition. Mr. R. J. Angel, the Borough Surveyor of Bermondsey, states that, in connection with the road-repairing work, there were lanterns suspended on trestles and a watchman's fire close at hand; and the nature of watchmen's fires, flaring and sparking before becoming incandescent, are well known. This is the weakest part of the whole of the evidence; but the uncertainty did not debar the Jury—wrongfully, we think—from absolutely placing the responsibility for the ignition on the Gas Company.

One piece of good has arisen from this lamentable occurrence. On Jan. 12 we pointedly called attention to the danger that exists from the continuance of old and disused sewers under the streets. Had the old sewer not existed in Grange Road, the opinion of all the experts is that this unhappy event and the whole of the contributory incidents would never have happened. Through it accommodation was given to the escaping water, to the washed-away soil, and eventually, when the gas-pipe could not longer stand the strain and fractured, to the escaping gas—giving it freedom over a considerable area. It is a satisfaction to learn from Sir Alexander Binnie that there are but few of these disused sewers in Subterranean London, and to hear from him, from Professor Vivian B. Lewes, and from Mr. J. W. Restler that, in their opinion, they should all be filled up or completely removed. Their opinions have the strongest of all support in the violent and fatal eruption in Grange Road. The matter of the existence of such sewers will not be allowed to remain where it is now; for reports will be brought before the various authorities concerned, and Dr. Waldo will forward to the proper authorities the recommendation submitted by the Jury, at his instigation, that an official inquiry should be made into the condition of old disused sewers and into the means generally of preventing any similar explosion in the future. Dr. Waldo's suggestion as to encasing gas and water pipes in concrete when laid in shifting soil is not a practicable one. As a matter of fact, there is no shifting soil to any large extent in London, excepting where tubes and other underground work have occasioned disturbance. There is, of course, a pretty considerable movement of the soil through traffic vibration; but sufficient movement, as in this case, to cause a pipe to be relieved entirely of support, and to act as a girder, is not of frequent occurrence. It would be a big and costly undertaking to open up the streets to find out, over the square miles of the Metropolis, where there is shifting soil, and to encase the water and gas pipes in concrete. In this Bermondsey instance, it was not so much the shifting soil that was the danger as the place left for the soil to shift into.

By Way of Provisional Order.

IT is to be hoped that the Provisional Orders Procedure Bill, which was very favourably regarded last session, will be revived in the coming one. The objects of the measure were to facilitate procedure in obtaining legislative authority by Companies, and to lighten expense, which most prospective or would-be promoters will regard as very laudable propositions on the part of Parliament, who alone can so order as to bring them to pass. The Bill was promoted last session by the Board of Trade, and went through the Lords—being in its passage made to apply also to the Local Government Board. Unfortunately, on reaching the Commons, the measure had to be dropped on second reading, owing, it may be supposed, to the weight of the arrears of legislative projects; this being the reason for abandoning several other Bills towards the close of the session. The Bill is brought to mind by the article elsewhere reviewing the deposited Provisional Orders referring to gas supply. There are sixteen all told; but the majority of them have been introduced by Companies or Local Authorities merely to supplement legislative powers already possessed by them through Act or Order. The Gas and Water Works Facilities Act has never succeeded to the extent that had been hoped in inducing the non-statutory companies to fortify their status and position, and to protect their consumers by applying for powers under the Act; and such companies were the ones whom it was desired to especially assist through the modification of procedure as designed by the Bill of last session. Therefore it is hoped that it will be resuscitated.

The Orders are for the most part without special feature. But they help to confirm what has been seen in the Bills as to the universality of activity of the gas industry in extending its benefits and its usefulness. Limits of supply are being pushed outwards, land powers are required for additional works, authorization for the erection of new works is required, and further capital is requested. It already looks odd, however, to see, as is seen in at least two of these Orders, the old auction clauses instead of the new regulations, and the old insurance fund clause instead of the special purposes fund clause. In such respects, there may as well be compliance with the model clauses right from the introduction of the Order, as the experience of the past two or three sessions is that, where there is non-compliance by promoters, the parliamentary authorities will set them right before much progress has been made. The authorities of Parliament who deal with these matters are formalists of the strictest kind. In the majority of the Orders, however, there has been complete observance of the present defined model clauses. There is one Order that should have the distinction of special mention in that, of all Gas Bills and Orders deposited for the coming session, it is the only one that contains the ancient testing clause, and not the new. It is the Hayfield Order; and, having regard to the practice of recent sessions, the promoters may certainly assure themselves at the present stage that the new testing clause will be incorporated before the Order is installed in the Confirmation Bill. At the present day, uniformity in testing is being aimed at; and the Board of Trade and Parliament have completely endorsed the aspiration of the gas industry in this respect. In the Orders as in the Bills, the 14-candle gas standard is adopted, with a single exception—the Coatbridge Order—in which 15-candle

power is suggested. To obtain authorization to the lower candle power, with the modern testing regulations, is the sole object of the draft Order of the Company; and this shows one of the valuable features of Provisional Order procedure—that through it any single new power, or a small number of new powers, can be easily realized and at moderate expense. There are two or three instances of this in the present group of Orders.

The proposed reduction of the standard illuminating power by the Coatbridge Gas Company is accompanied by a similar application by another Gas Company in Scotland. That is, the Musselburgh Company. We are exceedingly glad to see this movement in Scotland, as it evinces a spreading desire to get away from the wasteful illuminating powers to which much of the gas across the Border is now worked up, to the detriment, under modern means of use, of both supplier and consumer. The success scored last session by the Musselburgh Company's neighbours—the Edinburgh and Leith Gas Commissioners—for a rational amendment is sure to have considerable influence; and with such a precedent, and the concordant action of Parliament over several sessions in respect of English gas supply, the Musselburgh Company may have confidence that they will, before the session expires, have a 14-candle standard and Coatbridge a 15-candle one, though (unless policy of which we are not cognizant dictates otherwise) Coatbridge might just as well have come down in standard to the 14 candles prescribed in the model clauses. According to the last Board of Trade returns, the existing standard of the Coatbridge Gas Company is 20 candles, and gas of about 23 candles has been supplied. At Musselburgh a 22-candle standard exists; and about 24 candles is the illuminating quality supplied. This is sheer waste; and such gas is far from being the best to use in a bunsen burner. Certainly such a thorough intermixture of gas and air cannot be obtained as when gas of lower illuminating power is supplied; and in this is found one reason why the illuminating results from an incandescent burner do not increase *pari passu* with the (taking a reasonable bottom figure) candle power of the gas. Though progress is slow in Scotland in resigning custom in favour of requirement in respect of the candle power of gas, it is sure; and example will doubtless accelerate the pace.

Technical Affairs in Australia.

In the last and current week's issues, is published a report of the annual proceedings (forwarded by the Hon. Secretary and now President-Elect, Mr. P. C. Holmes Hunt) of the Victorian Gas Association. The meeting was held, under the presidency of Mr. S. E. Figgis, at Ballarat, where gold mining is the actively pursued industry, and the street gas-mains and the leakage account consequently suffer, and cause Mr. Figgis and his staff perennial anxiety. The topics before the meeting were varied, through the supplementing of the President's Address and the one paper read by the American idea of the "Question-Box." Those engineers and managers whose spheres of labour are of larger order than those of the majority of the members of the Victorian Association, will find, on reading the report, that several subjects that are yet live ones among the managers of the smaller of the Australian undertakings are matters that have long since been set aside as settled in this country. Size and environment, however, make a tremendous difference in the rights and wrongs of many a question. There is the subject of the proper means of using oxide—that is to say, the close form of oxide that is available to the managers of many of the Australian gas-works. They are able to talk at considerable length on their experiences with it, more especially as to the use with it of breeze and sawdust. Without some such expedient, the oxide becomes quickly clogged, thus losing efficiency, and causing labour in removing and returning the oxide to the purifiers. It was suggested by one speaker that, while breeze enabled the oxide to work freer, the breeze did not itself purify gas; and therefore, by reducing through its use the purifying area, he could not see that it would increase very much the useful life of the contents of a box. Of course, there are various ways of looking at the matter; and if the gentleman in question will consider that the opening of the oxide by the breeze renders the material more porous, he may agree that the additional permeability will expose a greater useful purifying surface to the gas. Some of the members, too, seem afraid of using air in their boxes; but, with careful proportioning, there should not be any trouble, any more than there is in this country. It will also be strange to many managers at home to read a discussion as to how best to get rid of ammoniacal liquor without causing nuisance and damage by pollution. It shows the sequestrated condition and comparative smallness of many of the undertakings when there is a general discussion on how best to run to waste a residual containing valuable ammonia. Chrysanthemum growers, with ammoniacal liquor available, should read this particular discussion.

But it must not be imagined that the smaller details of working alone occupied consideration at the meeting. The larger questions of the day—coal, carbonizing, and competition—are just as much in the thoughts of our distant professional friends as they are at home; and many an interesting fact is to be drawn from the address of Mr. Figgis on these topics. The coal question has been for Australian gas managers as at home one for anxiety. In their case, the price has been increasing, while the quality has been decreasing. This has a double-barrelled effect on the finance and working of their undertakings; for while expenditure has been going up, the primary product per ton of the more costly coal has been going down. This is not a happy position; but our friends must be congratulated on the discovery of vast deposits of good gas coal in the Maitland district, which, in experimental working, gives about 13,000 cubic feet of a high illuminating quality of gas per ton. Wood for fuel is cheap in Australia, and outside the large cities gas is comparatively dear—running up to as much as 6s. 10d. per 1000 feet, according to only one figure quoted by the President. At this price there cannot be any active trading in gas for cooking and heating purposes; and therefore to a considerable extent the gas business must be run practically on lighting alone, and in that electricity assails with a vigour quite equal to that encountered in this country. There is not the slightest need for high quality illuminating gas now; and the rich Maitland coal suggests that those administering the smaller gas undertakings would do much better by broadening their trading abilities by reducing the illuminating quality of their gas, and cheapening it by perhaps adopting some simple and moderate priced blue water-gas plant. The President made a similar suggestion. This appears to be the outlet to larger possibilities for the majority of the small gas-works of Australia; for mechanical operation and vertical retorts are, for the majority of their managers, in the present for admiration and not adoption. But of the two the vertical retort on a reduced scale may, in time, be adapted to their needs. They are keenly alive to all that is transpiring in this direction in this country and on the Continent, and follow achievement with intense interest. While mentioning this matter, one slip in the copy of the President's Address as received may be corrected. It stated that the Woodall-Duckham retort produced as much as 14,000 cubic feet per foot run per day. No doubt the inventors wish this were true. If it were, their fortunes would be made; but the difference effected by the excision of one of the cyphers brings us nearer the truth.

In the commercial department, there is, in connection with the smaller concerns, restriction of the capacity for business through the heavy price of gas; but in the lighting branch, there is an activity not excelled by the much larger and well-conditioned undertakings at home. Mr. Figgis tells us that, in the case of his own Company, the Directors have determined to undertake, free of cost to the consumers, the inspection and cleaning of incandescent burners, and at low prices the supply of the mantles and chimneys required. The competition of electricity with gas, at such prices as are mentioned, necessitates a broad and considerate policy. But in economy gas leads. Mr. Figgis finds that at 6s. 10d. per 1000 cubic feet, it is more than 100 per cent. cheaper than electricity at 5d. used with the Osram lamp. We do not, however, know the inverted gas-burner to which the President refers, that will give 30 candles per foot of gas at the pressure and quality that obtain in Ballarat. There is one question that he puts to which it is impossible to give an exact answer. In Ballarat a charge is made of ten guineas a year per 6-ampere flame arc lamp, in use from dusk to ten p.m.; and Mr. Figgis desires to know how this compares with London. In London, the electricity supply is in the hands of over thirty companies and local authorities; and their charges for public lighting, and the number of hours' use, have an exceedingly great diversity. With all their experience, however, electricity suppliers have not settled down to any comparable basis of charge for street lighting; and in the procedure of many

of them, in their burning desire to wrest from the gas companies as large a part of their business as possible, they adopt the most commercially unprincipled methods. There is, therefore, in this matter, in London as in Australia, an exuberant crop of what the President characterizes as missionary enterprise. We cannot find that any 6-ampere flame arc lamps are used in any district in the Metropolitan area. But in one, in which the local authority own the electricity supply, there are 7-ampere flame arcs, the price for which is £11 a year. For electricity the Council only charge public lighting 1d. per unit; but how many hours the lamps are used is not within our knowledge. With flame arc lamps, though electricity be supplied at a low figure, chemical carbons, labour, and maintenance are very important items in the costs involved.

Retirements and Regrets.

Mr. S. J. Acland, the Managing-Director, Engineer, and Secretary of the Beaufort Gaslight and Coke Company, Limited, the latest bantling of No. 99, Cannon Street, resigned his appointment from the 1st inst.; and Mr. John Moxon, the Solicitor to the Company, has adopted the same prudent course. We do not think either of these gentlemen will care to associate himself again with any of the ventures floated by Eaton and his confederates from No. 99, Cannon Street. So far so good. But we should dearly like, now that Mr. Acland has freed himself from the undesirable meshes into which he had either been drawn through misrepresentation or misunderstanding or had unwittingly dropped into, to hear his defence of the statements in the prospectus attributed to him and in the report to which his name was appended, and of the amount of capital it was desired to extract from the public for such an undertaking. If there are any shareholders who have parted with any money on the strength of Mr Acland occupying the official position he did, it is his duty to do his best—and freely—to aid such shareholders to recover their money. However, we are pleased, though mischief may have been done by the prominence given to his name, that Mr. Acland has thus early severed his connection with these promoters. Since the foregoing was written, Mr. Hubert Russell has also severed his connection with the Company. But what about the Amman Valley Company? Is he going to face Parliament as an official of that undertaking, and as a prospective Director of the statutory concern whose affairs are such that the Directors took good care the Press was kept outside the doors on the occasion of the recent Wharncliffe meeting?

The Board of Trade and Arbitration.

Some time since, comment was made in the "JOURNAL" on the scheme of the Board of Trade for the appointment of Courts of Arbitration, superior to those to which reference has hitherto been made, for the settlement of trade disputes. There was to be no obligation for any party to have recourse to such a Court; and this fact when made plain stemmed the threatened flood of Trade Union opposition. It does not matter what form of tribunal, so long as it is strong and of good repute, is set up for the purpose, providing there is no compulsion (which is repulsive to the trade unionist) respecting adoption; and compulsion is altogether absent in this instance. It is, we believe, an honest attempt to create something in this line that is an improvement upon anything previously done in the same way. That the project has generally commended itself, and on more mature consideration has not aroused any great hostility, is attested by the fact that the Board of Trade have now issued regulations to govern the appointment of the arbitrators and the procedure of the Court, with power for the appointment of technical assessors to give the Court information on technical points. The regulations are not extensive; and they are reproduced in our "Miscellaneous News." Though regarding in favourable light these Arbitration Courts, we have a preference for schemes that prevent the occurrence of disputes requiring subsequent settlement.

More Figures as to Local Government Finance.

The last of the eight Blue Books dealing with Local Taxation matters for the twelve months ending March, 1906, which, as is stated in another column, consists of a summary and index, contains an explanation as to why these valuable statistics are always so late in making their appearance in printed form. It is pointed out that the systematic arrangement and tabulation of the financial transactions of so large a number of local authorities—there are no less than 25,500 dealt with—having so great a variety of functions, is a work of much time and labour. Very few of the returns from which the particulars are tabulated can be obtained from the authorities immediately after the conclusion of the financial year, as they cannot be prepared until the accounts have been made up and audited—which entails a delay running into months. The accounts of most of the authorities are, in each district, audited by the same officer—the district auditor; and so, of course, they cannot all be attended to at the same time. On the other hand, in the numerous cases where the accounts are not subject to audit by a district auditor, the labour involved is increased owing to the different methods of keeping the accounts adopted by different authorities. For the purpose of securing accuracy, the returns are carefully examined in the office of the Local Government Board; and there is considerable correspondence as to apparent errors, or points upon which further information is required. The figures dealing with the year 1905-6 are, as already remarked, noticed elsewhere; but, in addition to these, the Blue-Book contains comparative statistics which show what has been the financial tendency during the period between that year and 1899-1900. In this time, the outstanding loans have gone up from £293,864,224 to £482,983,929. But the latter figure includes the exceptional item of £47,438,852 for the Metropolitan Water Board; and deducting this the normal increase may be said to have been to £435,545,077, which is still a sufficiently significant growth. If now we include the Water Board, the average amount per pound of rateable value of loans outstanding has increased in the same period from £1 13s. 6d. to £2 7s. 7d.; and per head of the estimated population from £9 4s. 4d. to £14 2s. 10d. The average amount per pound of valuation of public rates raised has gone up from 4s. 11·8d. to 6s. 1·2d.; and per head of the population, from £1 5s. 7d. to £1 14s. 1d. The total amount received from rates has gone up from £40,734,219 to £58,255,544. While in the six years the amount of outstanding loans on gas-works has increased from £19,819,301 to £23,716,522, that for electric light undertakings has grown from £7,853,061 to £27,492,817. The receipts from gas-works have in the same period increased from £6,035,526 to £7,073,249; those from electric lighting undertakings, from £910,329 to £2,853,537; and those from water-works, from £3,730,219 to £4,429,778. The total receipts have grown from £77,202,175 to £113,717,976 between the years 1899-1900 and 1905-6, which is not in the same proportion as the increase in the debt. In 1901, the rateable value of property assessed to local rates was £186,562,760; and in 1905 this figure had increased to £202,858,961—which again is not in the same proportion as the increase in the loans.

The Méker Burner and Furnaces.

Under the title of "A New Development in Gas Heating," we publish to-day an article giving some interesting information regarding the inventions of M. Méker, a French Chemical Engineer, whose burner is already more or less familiar, by name at any rate, to some of those connected with the gas industry in this country, and who has spent several years in the development of his apparatus. It is claimed that the scientific and novel design of this burner results in a flame far hotter than that given by the ordinary bunsen burner, with the consequent result (as tests carried out by a Committee appointed by the Société Technique in France to investigate apparatus for heating by gas show) that an economy of gas consumption of 50 per cent. may often be secured, while at the same time a great saving in the period required to attain any particular temperature is also obtained. M. Méker it may be remarked, was awarded the diploma and silver medal of the Société, together with a money prize of 300 frs. There have been designed by M. Méker—as will be gathered from the particulars and illustrations included in the article—a series of useful furnaces employing his burner; and in these it is said that exceedingly high temperatures can be secured quickly, easily, and economically. For example, in one particular pattern it is possible to melt copper (the temperature required for which is 1084° C.) without an air-blast, which in itself is regarded by the Cambridge Scientific Instrument Company, Limited—who have acquired the sole rights in the burners and furnaces for Great Britain and the Colonies—as a great achievement.

The Parliamentary Levy.

Pending the hearing by the House of Lords of the case in which the Court of Appeal recently gave a decision, the question of the legality of Trade Union levies for the purposes of parliamentary representation cannot, of course, be regarded as finally settled. At the same time, until the judgment of the Court of Appeal is upset, it must be taken as governing similar cases. Therefore in two applications which were before the Courts last week, the point which the Judges had to determine was whether the circumstances were identical with those in the original action which is to be taken to the House of Lords—*i.e.*, whether the levy was "compulsory;" and in both instances it was decided that it was. In the one case, the rules were read of the London Society of Compositors, to show that the Society were to have a Parliamentary Secretary, who must be a Member of Parliament, the chosen candidate of the organization, with a salary of £300 a year; and that a levy of 1s. per member per annum should be made to secure the return of a candidate who was a member of the Society. Mr. Justice Joyce held, with such evidence before him, that the payment under the levy for this parliamentary purpose was, according to the rules, compulsory. The second was a County Court case decided by Judge Bryn Roberts, who came to the conclusion that the plaintiff was entitled to the injunction for which he asked to restrain the South Wales Miners' Federation from raising and distributing money for the purpose of "paying the expense of returning and maintaining representatives to Parliament and other public bodies." This was not one of the original rules, but was agreed to by a majority in 1901, while plaintiff was a member of the Federation, and in spite of his protests. For some time he refused to pay; but ultimately at the colliery in which he was working it was decided to bring out the men unless all could show clear cards indicating that their levies had been paid-up. Faced with the alternatives of paying or losing his work, the plaintiff naturally chose what he regarded as the lesser evil; there was certainly nothing about his action that savoured of the "voluntary." However, it was contended, though unsuccessfully, for the defence that, as the levy was not made under one of the registered rules of the Federation, but was a separate matter, with a special fund and accounts, and had been decided upon by a majority of the members, it could not be regarded as "compulsory," in the sense of the case decided by the Court of Appeal, which concerned the Amalgamated Society of Railway Servants. It is expected that the House of Lords will hear the appeal in the original case some time in April; and meanwhile the last-named Society are making their parliamentary fund voluntary. What the Miners' Federation will do would seem to be uncertain; for the injunction granted in that case is merely an individual one, and, as a miners' agent pointed out, every man who objected to pay the levy might be forced to go through the same process as the plaintiff in that action. This, however, in view of the clear decision given, would, it seems likely, merely be putting them to unnecessary trouble and expense. As a way out of their difficulty, the dissentient miners are proposing to seek an interlocutory injunction, such as was granted in the case of the London Society of Compositors, so as to prevent the Federation from raising any further funds by means of parliamentary levies and using the money they now have in hand. On the other side, it is reported that the Federation intend to appeal against Judge Roberts's decision.

Electricity a Weapon for Employees.

The electric light appears to be a particularly useful servant of labour. The Paris electrical workers have twice shown how to employ it by imposing inconvenience upon a considerable section of a city to gain their own ends; and now an illustration appears to have been furnished nearer home. There were a large number of people waiting admission to one of the latest of London's theatres—the Waldorf—on Saturday night, when suddenly the theatre lights went out; and it was announced there would be no performance. According to the statements in the daily papers, some of the seatholders were informed that the decision had been arrived at owing to the failure of the electric light. But other news got abroad that there was a dispute with the bandsmen as to wages; and that the theatre electricians had sided with their musical colleagues—extinction of the lights being the result. Is electric lighting so troublesome in a theatre that it must have a special staff of trained men to look after it? The Charing Cross and West-end Electricity Company are the suppliers; and, so far as can be gathered, there was nothing amiss with the general supply on Saturday. In fact the theatre has a duplicate supply, so that, in the event of one of the supplies failing, the other can be switched on. If there was a failure on this occasion, it was purely local; but it looks as though the salary question was at the bottom of the extinction.

Suction-Gas Plant Experiences.

A collector of experiences, Mr. F. V. L. Mathias, of Warrington, has been obtaining from electrical engineers the experiences with suction-gas plants of firms in their areas of supply; and the collection has been published in the "Electrical Times," and is reprinted in other columns of this issue (p. 403). The inquiries were addressed to station engineers "all over the country;" but if the towns mentioned in the article represent the sum total of the replies, Mr. Mathias must be a little bit chagrined at the slight his inquiry "all over the country" received. Perhaps circular inquirers are as much detested in the electrical as in the gas industry. Though in some respects the testimony confirms that which is within our own knowledge, the reports made to Mr. Mathias, being prepared by electricity station engineers, are no doubt tinged with a little bias, and must therefore be taken with the proverbial grain of salt. A considerable number of towns report no serious competition with suction gas—that is to say, the competition has either been easily overcome, or has never become a serious menace. We also could select a large number of towns where there is no serious competition from suction gas with town gas; but that is on account of either the lowness of the price of town gas, or the fact that there is not much scope for power agents of any kind. Citing a few towns out of the whole number in this way does not, however, prove the non-existence of serious competition with town gas or with electricity. When we are told by one who ought to know, that a "vast number" of gas-engines have been put down with suction-gas plants, the descriptive expression (though indefinite) conveys to our mind something that cannot be treated in the business competition of the times in a contemptuous fashion. It is better to overrate the strength of a rival than to underrate it. Another series of towns gives illustration to places (according to the electrical compiler) where the electricity undertakings do not appear to have felt the competition much; but without being precise as to the keenness or slackness of the competition, they either record unfavourable experiences of suction gas plants, or mention cases where electric motors have replaced them. The testimonials are certainly not good for the suction-gas plants; seeing that in several cases the plants have been displaced, and efforts—generally unrewarded ones—have been made to find a purchaser. Of course, the reports are all coloured in the deepest of electrical tones. There is no doubt, however, that the reporting electricians mentioned all the instances of replacement within their knowledge; and they do not amount to many. There is an omission by the electricians in not stating the instances in which electric motors have been displaced by suction-gas plants, or by engines fed by town gas. The latter, however, did not perhaps come within the scope of inquiry. A gas engineer in a district where power agents are required for industrial purposes must be a rarity if he cannot give examples of electric motors having been supplanted by town-gas engines.

The Livesey Memorial.—The Engineering Supplement to "The Times" last Wednesday contained an article from a correspondent directing attention to the new department of Gas Engineering and Fuel at the Leeds University, and to the decision of the Institution of Gas Engineers to endow a professorship there as a memorial to the late Sir George Livesey. The writer explains that it was the original intention of the University authorities to regard the study of the gas industry in its various phases as an offshoot of the mining department; but it was finally decided to found the separate department, with an independent professorship. This course was based on the recognition of the existence of many unsolved problems having relation to the manufacture and use of gas. It was realized that, to ensure the full development of the industry, its future controllers should be given an opportunity of obtaining a thorough practical, theoretical, and scientific knowledge of their calling, and also that facilities for comprehensive research work should be available. He adds that "it is peculiarly fitting that the Livesey Memorial should have taken the form of this endowment, because Sir George Livesey became enthusiastically interested when the scheme to inaugurate the new department was first put forward."

THE LIVESEY MEMORIAL FUND.

The following letter from Mr. Charles Carpenter came to hand yesterday.

SIR,—There appears to be no doubt whatever that certain gas companies (London, Suburban, and Provincial) have withheld subscriptions to the Livesey Memorial Fund because, in the words of the President of the Institution of Gas Engineers, "they are looking to the South Metropolitan Company for their lead in the matter."

There are, in my opinion, many and weighty reasons why the duty of leading the way in this act of homage to its late Chairman's memory would have come with greater grace from some other source than the Company with which his name must always be associated.

But I suppose that looking for a lead to the South Metropolitan Company had, under its late Chairman, become so much a habit that it is difficult to depart from it at his death. Greater testimony could not, I think, be given to the position the Company had achieved under his management; and a desire so strongly expressed that it should lead the way in this, as it had often done in other matters in the past, can with difficulty be put aside.

I confess I had hoped that appreciation of the position this Company occupied under its late chief might have been expressed differently, and that it might have been left to provide in its own way its own memorial to the memory of its dead chief. In this, I have been disappointed; but I have no doubt that the Board will, on their next consideration of the matter, take such action as will accord with the suggestion that it should once more lead the way.

CHARLES CARPENTER.

South Metropolitan Gas Company, Feb. 8, 1909.

WE have received from Mr. Walter T. Dunn the following list of further contributions to the above fund.

1909.		£	s.	d.
Feb. 1	Amount already acknowledged	2794	13	0
,, 2	J. Ferguson Bell, Derby	10	10	0
	Charles F. Botley, Hastings	1	1	0
	A. G. Glasgow, London	21	0	0
	Joseph Hepworth, Edinburgh	10	10	0
	J. W. Morrison, Sheffield	3	3	0
	Pudsey Gas Company	10	10	0
,, 3	M. Abbott and Co., Limehouse	3	3	0
	Bingham Gaslight and Coke Company	1	1	0
	Andrew Dougall, Tunbridge Wells	2	2	0
	John T. Jolliffe, Ipswich	5	5	0
,, 4	H. O. Carr, Wandsworth	1	1	0
	Bryan Donkin Company, Chesterfield	5	5	0
	Great Grimsby Gas Company	5	5	0
	A. Vernon Harcourt, Ryde	5	0	0
	H. C. Head, Winchester	5	5	0
	J. W. Helps, Croydon	7	7	0
	Samuel Milne, Aberdeen	2	2	0
	H. Rayner (The Gaslight and Coke Company)	2	2	0
	H. Smythe, Maidstone	1	1	0
	D. Milne Watson (The Gaslight and Coke Company)	5	5	0
,, 5	Stephenson Clarke and Co, London	26	5	0
	S. S. Field, South Metropolitan Gas Company, East Greenwich	5	5	0
	Sir J. Fortescue Flannery	5	5	0
	Henry Woodall, Llandudno	10	10	0
,, 6	John Borastin, South Suburban Gas Co.	5	5	0
	Cheltenham Gaslight and Coke Company	52	10	0
	Dudley Gaslight Company	10	10	0
	B. Green, Mitcham	1	1	0
	B. R. Green, Mitcham	1	1	0
	Irthlingborough Gas and Coke Company	2	2	0
	Kildwick Parish Gas Company	5	5	0
	R. O. Paterson, Cheltenham	15	15	0
	A. Canning Williams, Secretary, Reading Gas Company	1	1	0
	Worthing Gaslight and Coke Company.	21	0	0
,, 8	Alfred Bevis, Surbition	2	2	0
	Wrexham Gas Company.	10	10	0
	Total	£3077	18	0

The current number of the "Co-Partnership Journal" of the South Metropolitan Gas Company records the death, in a railway carriage, when on his way to business, of Mr. George Drumgold, the Company's Chief Storekeeper—a position to which he was appointed on the retirement of Mr. John Surman in 1906. Deceased was 61 years of age.

THE HOMELESS GAS WORKERS OF MESSINA.

Position of the Fund to Date.

WE are pleased to acknowledge the following additional contributions to the fund which is being raised for the gas workers who have suffered by the earthquake at Messina—bringing up the total to £487 18s. 11d.

	£	s.	d.
Amount brought forward	339	0	5
M. Derval, Paris	4	0	0
Mr. H. C. Head	1	1	0
Messrs. Parkinson and Cowan	2	2	0
Directors of the Northampton Gas Company	21	0	0
Employees of Messrs. Cutler, per H. Wingrove	15	1	0
Further collection among staff and workmen of the British Gas Company, Norwich	1	0	0
Directors of the Harton Coal Company	100	0	0
Employees of the Redhill Gas-Works, per Mr. James Paterson	2	12	6
Herr Friedrich Lux, Ludwigshafen	2	2	0
	£487	18	11

PERSONAL.

Mr. A. H. MORRIS, Manager of the Alresford (Hants) Gas-Works, has been appointed Works Manager at Towyn to the Dysynni Gas Company, Limited.

No less than eighty-eight applications were received by the Directors of the Swansea Gas Company for the post of Assistant Engineer and Manager rendered vacant by the promotion of Mr. George Andrews to the position of Engineer and Manager, on the death of his father Mr. Thornton Andrews. Of these, the Directors selected six candidates for a personal interview last Friday, with the result, as will be seen from an advertisement appearing on another page, that Mr. REGINALD G. CLARRY, of the Gaslight and Coke Company's Shoreditch Station, and son of the Secretary of the Cardiff Gas Company, was selected to fill the post.

OBITUARY.

We regret to learn, through the "Journal für Gasbeleuchtung" of the 6th inst., of the death, on the 27th ult., of Herr M. DIETRICH, Manager of the Municipal Water-Works of Munich. Deceased had been an active member of a number of Commissions dealing with questions of water supply.

The death took place yesterday week of Mr. JOSEPH WILLS, one of the oldest of the public men of Plymouth. Mr. Wills, who was 95 years of age, was born at Great Torrington, and began business in Plymouth in 1830. He was a member of the Town Council for forty years, and Mayor in 1877-8. He was formerly a Director and Deputy-Chairman of the Plymouth and Stonehouse Gas Company, but retired from this and other public offices a few years ago, on account of advancing years.

The burial of Mr. JOHN CLARK, of West Ham (who died from pneumonia after a short illness, as recorded in last week's "JOURNAL"), took place on Thursday afternoon in the City of London Cemetery. At the graveside, a number of the deceased's colleagues were assembled; and all the Company's inspectors were present in uniform. Among the Directors attending were Mr. Lister Godlee, Mr. Nicholson, Mr. Pelly, and Mr. T. H. Geere. Other representatives of the Company included Mr. G. T. Gwinn (Superintendent), Mr. W. A. B. Bull (Assistant Superintendent), Mr. A. G. Snelgrove (Secretary), and Mr. E. Madge (Assistant Secretary). Among the many beautiful floral tributes were several from the different departments of the gas undertaking, and one from the Directors of the West Ham Gas Company. The coffin was made of light oak, and the plate bore the inscription: "John Clark, died Feb. 1, 1909, in his 68th year."

In the "JOURNAL" for the 19th ult., reference was made to the promotion of the Beaufort Gaslight and Coke Company (1908), Limited; and close scrutiny of the prospectus was advised, in view of the fact that the vendors of the Company were the Water-Works, Lighting, and Power Investment Corporation, Limited, of No. 99, Cannon Street. It was announced in "The Times" last week that the Beaufort Company's Solicitor (Mr. John Moxon) retired on the 1st inst., and that the prospectuses issued on or subsequently to the 30th of January were published without his knowledge or approval. The announcement of the resignation of the Solicitor was followed last Thursday by that of the Managing-Director, Engineer, and Secretary, Mr. S. J. Acland, who notified through the Press that his connection with the undertaking ceased on the 1st inst. Referring to these events, the "Financial News" last Saturday said: "These are highly interesting developments. The next question is the identity of the successors to the gentlemen who have resigned—unless, indeed, Mr. Eaton, as the presiding genius of the group, assumes their duties himself." These announcements were followed on Friday by a notification from Mr. Hubert Russell, one of the Directors of the Company, to the effect that he, too, retired on the 1st inst.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 409.)

BUSINESS on the Stock Exchange was more lively than the week before, but still it was not up to the point of even moderate activity. The tone, however, was a good deal better, and suggestive of recovering confidence, which may very well grow in the immediate future. For this benefit, we have to thank a more favourable money prospect and a relief from alarms in the Near East. A more cheerful disposition was discernible at the opening—some good buying orders helping railway secured and other gilt stocks, and lifting Consols ⅛; and the Foreign Market, where outside Balkan influences, being satisfactory. This good start was improved upon next day. The Eastern difficulty seemed fairly smoothed out, and markets in general became stronger and more active. On Wednesday, the issue of the big Indian loan, on terms which looked good for lenders, depressed the leading Market. Consols fell $\frac{3}{16}$, and the defection tended to spread. But on Thursday the disturbance abated somewhat; and Consols had a partial recovery. This improving turn was confirmed on Friday, and Consols had a further rise, while other markets revived in sympathy, though business was on a very light scale. Saturday was almost lethargic in its quietude; but the firm disposition was well maintained, and the week closed happily. In the Money Market, there was at first a fair demand, but it did not, unfortunately, last long. The weaker tendency, however, soon gave way in its turn, and thenceforward rates ruled steady. In the Gas Market, there was a recovery in activity, and business was fully up to the mark. The general tendency may be written as steady and unchanged; for there were not half-a-dozen variations in the whole list of quotations, and they were very slight advances. In Gaslight and Coke issues, the ordinary was particularly active, and Saturday (the day after the general meeting) was the briskest day of the week. Prices were very steady, ranging from 102¾ to 103½. The secured issues were quiet; the maximum marking 90¼ and 90½, the preference 106¼ and 106½, and the debenture 84⅝. South Metropolitan was rather inactive, and was unchanged at from 122 to 123. A single deal at 109 in the 4 per cent. was all the business done in Commercial. In the Suburban and Provincial group, Alliance and Dublin old was done at 18⅞, Brentford old at 250 (rise of 1), Bournemouth "B" at 16$\frac{13}{16}$ and 17, Ilford debenture at 102, Portsea "C" at 123 and 123½, West Ham ordinary at 115½ and 116 (rise of 1), and ditto preference at 126. In the Continental companies, Imperial was rather quiet at the same prices as the week before—179¼ to 180½. European fully-paid made 23¾ and 23$\frac{13}{16}$, and ditto part-paid 17⅝. Among the undertakings of the remoter world, Buenos Ayres was very active at from 12$\frac{1}{16}$ to 12$\frac{15}{32}$, Bombay old changed hands at 5$\frac{7}{8}$ and 5$\frac{11}{16}$, Monte Video at 11¾, Primitiva at 6⅛ to 6¼, ditto preference at 5⅝ and 5$\frac{5}{32}$, ditto debenture at 95¾ to 96¾, River Plate at 13$\frac{13}{16}$, San Paulo at 14$\frac{7}{16}$ and 14⅜, and Ottoman at 6¼ to 6⅜.

ELECTRICITY SUPPLY MEMORANDA.

Electric Trams, Flame Arcs, and Tradesmen—Kicking against the Pricks—Metallic Filament Guarantees—Prepayment Experience at West Ham—Registration Evasion by Electricity Slot Consumers—Complex Cost Comparisons.

THERE are among electricians different opinions as to the suitability of flame arc lamps for the outside lighting of shop windows. The lights to be of any use have to be hung too low; and so placed they are a perfect discomfort to the eyes of passers-by, and of questionable advantage to the users, through the dazzling character of the light where the lamps are suspended in close line. In passing, the attention of the City authorities may be called to the group of lights of one tradesman in particular in Fleet Street, who does not conform to the bye-law of the Corporation that such injury-inflicting lamps should be shielded on the "off" side. Where these lights are used in groups in this way in front of a single window, they play sad havoc with the general and reasonable shop and public lighting of the remainder of a thoroughfare. Those, however, are not the points with which this note is intended to deal. In a suburban district the other day, a tradesman, whose exterior lights are electric flame arcs and interior lights incandescent gas mantles, was heard to complain bitterly of all things electrical in his immediate neighbourhood, and particularly of the contract he entered into some time since for his exterior flame arc lights. The thoroughfare in which his shop exists has become notorious lately for empty business premises. A few years since electric tramways were laid down, and electric current was available for the shops along the route. The tradesman in question was tempted to have flame arc lamps. Plausible tales of their majestic advertising and magnetic power in drawing custom were trotted out by the oleaginous tongue of the electrical canvasser. The lamps were installed. By day, the metal casings of the lamps already show signs of wear, and are, together with the quickly dirtied globes, an eyesore to the shop frontage. By night, they decline to attract custom. The electric cars whisk quondam customers to the larger shopping centres. The pavement in front of the premises in what at one time was an important main shopping street of a residential suburb is now, during the evening, almost deserted. Business, instead of increasing, has decreased during the time the tramway has existed; and the fashion of going to large shopping centres has been continuously growing. The flame arcs have not saved the situation. On the contrary, they have caused an increase in the lighting expenditure, while the profits from the business have been diminishing. This tradesman stands alone, for some distance along the thoroughfare mentioned, as a user of flame arcs; and he is likely to continue so, as others agree with him that they have had nothing for which to thank the introduction of electricity in their particular neighbourhood.

It would appear from an editorial article in the "Electrical Review" that the queer commercialism of which there are so many evidences in the electrical industry has found a fresh place for a breaking-out in connection with metallic filament lamps. There has been allusion previously to the proposal to counterbalance decreased consumption through metallic filament lamps by increased prices per unit of electricity. We are not aware whether all the electricity consumers of the Metropolitan Electric Supply Company have received the communication, but, at any rate, one has, in which it is pointed out that the Company's Act prescribes that a month's notice must be given before any change is made by a consumer in the maximum power of his supply, and that he must bear all expenses connected with the inspection of his installation, change of meter, &c.—such expenses amounting to from £1 to £2. The special rate for basement lighting is also withdrawn by the Company; and rules have been framed by them for the installation of transformers, and particulars are demanded of consumers concerning those introduced. Our contemporary detects at the back of this letter an obstructive policy on the part of the Company, and a taking of undue advantage of a loosely-limbed clause, which was obviously intended to refer to an increase and not to a decrease of the maximum demand. Next thing the peculiar and capricious administrators of some electricity concerns will want to do will be to define the level line at which their patrons must consume current. At the present time, they treat their customers as though in supplying them they were doing a favour, and not that the customers are favouring them by their patronage. The Brompton and Kensington Electricity Supply Company have also made a little sally against transformers, by issuing warning that there will probably soon be no need for them. They are willing, however, to supply transformers, if required; but where contractors furnish the instruments, they are to be submitted to the Company for testing and approval. The electricity companies appear to have a very vague idea as to where their power of control ends. They cannot dictate to a consumer what he shall or shall not employ in the way of means of utilizing the electricity he purchases; and they are bound to supply a consumer within a certain distance of the distribution cables, provided the wiring of his premises is not below specification level. Our contemporary remarks: "That the new lamps will eventually come into universal use cannot be doubted. What is the good of trying to stem the tide? Surely it were far better to utilize the undeniable advantages of the metallic filament lamps for the purpose of combatting the common foe, and winning from the gas suppliers compensation—and more than compensation—in the shape of thousands of new consumers." "Common foe!" and "winning from the gas suppliers compensation in the shape of thousands of new consumers!" Well, we are obliged to our contemporary for its honesty in describing the gas industry as it feels towards it, and for making such a clean breast of its raiding inclinations to strip the "foe" of much valuable property.

While some companies are adopting an obstructive attitude towards metallic filament lamps, the keenness of competition among the makers of the lamps has brought down prices—not much per lamp, but by a sum that makes a material difference on a large installation. This has been a concession forced by the initial action of manufacturers in the strongest position against the smaller makers who were making a vehement attack upon them on all sides. But another factor has obtruded itself into the situation; and that is the question of terms in respect of breakages and failures. Contractors appear to have compelled, through the increase in the number of makers upon whom they can confer orders, the giving of a little more elasticity to lamp guarantees. Lamps of the metallic filament type that come to a violent end in course of transit are not of negligible quantity; and makers, when in the enjoyment of their pristine success, were disposed to treat with narrow view the claims to consideration for losses occasioned before lamps entered the retailer's possession. Competition has produced a more rational feeling in this matter, and conditional guarantees are now freely offered in respect of breakages of the fragile filaments that occur *en route* between maker and seller. Among other inducements for custom, certain makers have voluntarily offered to replace lamps that prematurely fail; and there are those who will, rather than sacrifice a potentially good customer, give a life guarantee. Before the pressure of competition produced this change in circumstances, contractors were growing frightfully dubious as to whether the vending of metallic filament lamps had anything in it for them. Some people think the manufacturers are able to give the guarantees on account of the greater durability of the filaments used. The stronger the filaments, the less would be the necessity for guarantees. Of competition and confidence, the former in this instance is the greater influence.

Mr. A. Hugh Seabrook, the Electrical Engineer of West Ham, does not bear a very good opinion of his department or, reading

between the lines, of himself; and when a man gets into that condition, his friends may consider the case hopeless. If we are to believe his Chairman (Alderman Crow by name), the Electricity Department is one of the most enterprising businesses in the borough of West Ham. It disposes of something like 15 million units a year, makes deficits, and works on merrily at creating a wonderful financial maze, which the ratepayers cannot penetrate, but out of which they are called upon to assist the department to wriggle. Mr. Seabrook appropriately describes the undertaking he has charge of as the "ugly duckling" of the Municipality; and he confesses that it is ageing him somewhat rapidly. In his weakness last year, he confesses to having indulged in prophecy which has not matured. He says that now he is one year older in days, and ten years' older in experience. It is more than human nature can stand to progress at the latter remarkable rate; and so Mr. Seabrook should be urged by his friends to husband his powers, and be content for the present. With such a rapid accumulation of experience, however, there ought to be a change in the fortunes of this ill-starred concern; and therefore we shall look with some interest to the accounts for the financial year to March 25 next. Among the ventures of the enterprising undertaking has been a branching-out into the prepayment business. Mr. Seabrook has to admit its failure. The annual cost of collection, repairs, and capital charges in connection with the slot meters in the Council's artizans' dwellings and other private houses amounted last financial year to £251; and the revenue from the electricity supplied through these meters, to £362. This being so, there was only £111 remaining with which to pay generating and works costs, distribution, and the proportion of the other expenses associated with the supply up to the meter. This is not good enough. It has been decided to place all matters in connection with this branch in the hands of Mr. Seabrook. We wonder what his course will be. It does not, as a rule, take a very large experience of the slot-meter business in connection with electricity supply to show those engineers who keep a careful account of all expenses associated with it that their undertakings are better off by avoiding it.

Electricity slot meters appear to lend themselves to the little tactics of people who believe that artificial lighting should be as free as the air. The Northern Counties Electric Supply Company have among their prepayment consumers at Hirst and Ashington, ladies of resource. Some half-a-dozen of these were summoned to appear at the Morpeth Police Court a few days ago for having stolen electric current by shunting their meters by the use of wire and pins. One of the defendants regarded her depredatory conduct as of such slight importance that she failed to answer the summons, and a warrant for her arrest was issued. The case was dismissed against a second of these fair customers, as it seems that it was her son who, in her absence, had developed the necessary amount of ingenuity for fixing the shunting wires. The meter of a third defendant only confessed to having passed two pennyworth of electricity in a month; and so the cases went on. The salutary fines of £3 and costs were imposed, or in default a month. Salutary though the penalties were, the defendants had laid themselves open to two years' penal servitude. It appears that there has been an epidemic of these cases in the district, and there is an intention of increasing the punishment till an end is put to this kind of thing. Electricity supply through slot meters pays badly enough, without the suppliers having to also incur loss through thieves.

A correspondent recently sent us a copy of "A Practical Trade Paper"—known as "Electricity," and purchasable at a penny, including a "£15 insurance for death by electric shock." This provision on the part of the Editor is praiseworthy. So far as the number to hand allows judgment, the paper appears to be conducted with a becoming modesty of opinion. Whoever sent the paper took care to attract attention to an editorial article on the comparative cost of gas and electric light by scoring down the margin of the page with a blue pencil. We have long since got accustomed to this sort of thing on the part of those electrical contemporaries who wish to ensure that their vigorous words but less vigorous judgments shall not pass unnoticed. The article in "Electricity" has been read; and it is found to be harmless enough. The subject, in fact, is too complex for the writer of the article to deal with. That is his own admission. "At first sight, the question appears simple enough;" but "it is not by any means so simple as it looks. . . . So many factors, indeed, have to be first taken into consideration, that the matter speedily becomes decidedly complex." It is a sage piece of advice that the Editor proceeds to give his readers. As a practical way of dealing with the matter, he suggests that it is best for electricians to content themselves with supplying *exact* figures as to the cost of the electric light, and leave the inquirer to obtain his own data as to gas. That is certainly sound counsel. Electricians never have been good at figures. From the estimates of the cost of laying down an electric lighting plant to the estimates as to trading profits, and to the non-compliance of consumers' accounts with predictions, exact financial measurement has never shown itself to be their *forte*. It is a pity, because a greater accuracy would have saved such a lot of heart-burning and vexation—from the Local Government Board and electrical officials down to the discontented electricity consumer, who finds that, when he listened, he omitted to apply the necessary grain of salt to what he heard. There is, therefore, absolute agreement with the Editor of "Electricity" that "it is usually the best policy" for electricians to pursue, "to work out the cost of electric light independently of anything else, and trust that the reasonableness of the figures arrived at will be the recommendation, outside any theoretical comparisons with other rivals." We suppose the description "theoretical comparisons" is the best possible of those of electrical origin. If only electricians accept the advice of their well-meaning mentor, they may depend upon it that from their much envied rivals costs for gas will be given that will work out in experience with an approximateness that will give satisfaction. It is agreed that, in connection with the use of gas, we have fewer factors to be taken into account than is the case with electricity.

THE INVERTED HIGH-PRESSURE LIGHTING IN FLEET STREET.

Our friends of the "Electrician" appear to be deeply jealous of, and highly excited over, the inverted high-pressure gas-lamps in Fleet Street, judging from their repeated references to them. They describe as returning to mediæval times the use of gas-lamps giving an illuminating power of 1500 candles on the low consumption of 25 cubic feet of gas per hour. It is strange they cannot find an apt expression for the occasion, instead of one that is absolutely meaningless. Their latest paragraph reads:

> A few weeks ago we referred to the "up-to-date" display of gas lighting in Fleet Street; and recent experience has not caused us to modify the views we then expressed. In fact, the ridicule with which the display was first greeted has now turned to annoyance at the inconvenience caused to pedestrians in that busy thoroughfare. It comes as a surprise to the average foot passenger to be "charged" without notice by men trundling a clumsy tower-ladder, in order that they may, with their "equipment," effect a landing on the pavement. This has become the daily experience in Fleet Street; and all for what? To keep in working order a few modern gas-lamps. An instructive lesson in the amount of "dirt" from this mode of lighting is also furnished by the colour of the globes after a few hours' use; and it is amusing to see the strenuous endeavours to change the globes at frequent intervals, each time to the inconvenience of wayfarers. When one realizes the difference between the installation in Cannon Street and that in Fleet Street, surprise gives way to annoyance that the City Fathers should sanction such a return to mediæval times. The inconvenience to pedestrians in Fleet Street by the necessity of placing the tower-ladder on the pavement is so serious that we trust the Corporation will hesitate before again allowing gas-lamps to be installed in this manner, when they have the opportunity of installing arc lamps over the centre of the road, where the light is more effective.

The "ridicule" and "annoyance" have been confined to the staff of the "Electrician," for people with whom we have come in contact speak very highly of the new lamps. It is not to be supposed the writer of the above note is sufficiently acquainted with high-pressure gas lighting to know that the lights in Fleet Street are not yet working under normal conditions. The high-pressure gas supply is being run to various printing establishments for purposes other than lighting; and until the arrangements are complete, and the mains are continuously charged with gas at high-pressure, there will, but only temporarily, be need for more attention to the street-lamps than will be the case subsequently. The arrangements controlling the pilot lights of the lamps are designed for continuous running of the compressing plant; and as this condition is not fulfilled at the moment, there is a liability for the bye-passes not to work so satisfactorily as they will do in the near future. Then there will be less butting of the Editor, or other member of the staff, of the "Electrician" by the tower ladder at present used. This ladder is, we fully acknowledge, of a somewhat cumbrous nature; but it is to be replaced by a lighter one which will be more easily manipulated for ordinary maintenance purposes. A comparison of Cannon Street and Fleet Street by anyone but our contemporary does not reflect particularly to the credit of the electric lamps; for in Cannon Street the services of an extraordinarily cumbersome tower ladder have to be retained to reach the lamps, and, instead of upsetting the pedestrians, it has the effect of causing annoyance to the road traffic. We think there is, if anything on this score, credit to the gas-lamps, as they do not require daily attention, whereas the electric lamps, or some of them, do call for daily labour for one purpose or another. This is especially noticeable with the few lamps lately put up in Ludgate Circus. For these new flame arcs, over 2000-candle power is claimed; while the gas-lamp on the first rest in Fleet Street is only 1500-candle power. Which gives the better illuminating power—the so-called 2000-candle power electric flame arcs, or the actual 1500-candle power gas-lamps? The note by our contemporary as to the dirty globes was no doubt made during the foggy weather.

The following is one of the "Editorial Notes" in the current number of the "Co-Partnership Journal" of the South Metropolitan Gas Company: "Mr. Thomas Newbigging accuses the 'Journal of Gas Lighting' of *political bias*. We had not noticed this, and even now do not quite understand in which direction the bias is supposed to be—except that it is presumably not in the direction of Mr. Newbigging's politics, of which we are also ignorant. It is, however, a common charge. Men of less eminence than Mr. Newbigging have hinted the same thing about less important journals."

GAS LEGISLATION FOR 1909.

[Sixth Article.]

Pursuing our review of the gas legislation for the approaching session, the Provisional Orders lodged with the Board of Trade and the Local Government Board succeed the Bills that have been the subject of previous articles.

The first draft Order is that of the Bideford Gas and Coke Company, Limited, who are asking that, in addition to the capital authorized by their Order of 1892, they may raise additional capital not exceeding £12,000. In the issue of this, the provisions of the new auction clause, are to apply. The dividend suggested for the ordinary capital is 7 per cent., and 5 per cent. for the preference. Borrowing powers are proposed at the usual rate of one-third the issued additional capital. The new special purposes fund is incorporated. Lands are scheduled for additional works. The intention is that the standard illuminating power of the gas shall be 14 candles, tested by the "Metropolitan" No. 2 burner and the Harcourt 10-candle pentane lamp. The remaining clauses all follow model or precedent. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Birkenhead Corporation are asking to be empowered to use certain scheduled land for the storage of gas and for any purposes of, or in connection with, their gas undertaking, other than the manufacture of gas or residual products. That is the whole and sole purpose of the present application. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Brough, Elloughton, and District Gas Company, Limited, are asking for further capital powers to the amount of £4000, providing that the whole capital of the concern shall not exceed £10,000. The new auction clause will apply to the new capital. For ordinary and preference issues, the dividend named is 7 and 6 per cent. respectively. Borrowing powers are named on the usual one-third scale. Regarding the price of gas, the limit is put at 5s. 6d. per 1000 cubic feet. Among miscellaneous clauses, the old 10 and 15 per cent. discounts provision appears. [*Parliamentary Agents: Messrs. Torr and Co.*]

The Bude Gas Company are seeking power to use certain scheduled lands for gas-works purposes. The Company were only in Parliament in 1907, when power was given to raise £8500 of capital in 850 shares of £10 each. It is now asked that the "8" in both the amount of capital and the number of shares may be converted into "12." An extension of the limits of supply is proposed, to take in the parish of Kilkhampton in the county of Cornwall. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Calico Printers' Association, of Manchester, are the promoters of the Compstall Gas Order. The district of supply is defined as the urban district of Compstall and the portion of Ludworth in which the Marple District Council are, by section 6 of the Marple Gas Act of 1886, prohibited from supplying gas without the consent of the undertakers as successors in title of Montagu Woodmass. The capital proposed is £10,000, including £6000 already expended on the undertaking. The idea as to dividend is 10 per cent. Power is asked to create a special purposes fund, as well as to borrow up to one-third of the issued capital. Authorization as to the use for manufacturing purposes of lands at present in the occupation of the promoters, and near their mills, is included in the Order. The standard quality of the gas is put at 14 candles, tested in accordance with the modern prescription; and the price is not to exceed 5s. per 1000 cubic feet. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Coatbridge Gas Company are asking for the repeal of the section of their Act of 1877 referring to the question of the quality of the gas supply. It is proposed to substitute 15 candles as the standard, in testing which the "Metropolitan" No. 2 burner is to be used. [*Parliamentary Agents: Messrs. Robertson and Co.*]

The Hayfield Gas Company, Limited, are, according to their draft Provisional Order, desirous of increasing their capital of £4000 by the addition of £1000. The dividend on the original capital is limited to 10 per cent. and 7 per cent. on the additional capital issued as ordinary, or 6 per cent. on any part issued as preference. Including £600 already borrowed, the one-third rate of borrowing power is desired. We shall not be surprised to find in the Order as confirmed that the old auction and insurance fund clauses proposed are changed to the more modern provision in respect of the former and to the special purposes fund clause in respect of the latter. For gas of a standard value of 14 candles, the price proposed is not exceeding 4s. 6d. per 1000 cubic feet. The sole exception of the old testing clause appearing this session is found in this Order. That, too, we anticipate, will be duly altered. There is a purchase clause operative at any time after five years, if the District Council are duly authorized, and give notice in writing to the undertakers. In that event, the terms of transfer, if not decided by agreement, are to be determined by an arbitrator appointed by the parties, or in case of difference by the Local Government Board. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

Contemplating extensions, the Corporation of Ilkeston ask to be empowered to purchase some additional land and to erect gas-works thereon. The requisite borrowing powers are desired. Quality and testing of gas, and all other provisions follow the lines of the current model clauses. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Langley Mill and Heanor Gaslight and Coke Company, Limited, are proposing to extend their limits of supply and capacity generally. Land is scheduled possession of which is desired, and upon which it is intended to erect additional works. Further share capital is asked to the extent of £20,000; but it is provided that the whole share capital of the undertaking shall not exceed £50,000. The new auction clause is to be applied. Dividend on the new capital is not to exceed 7 per cent. for the part issued as ordinary, and 6 per cent. for the part issued as preference. Borrowing powers will follow the ordinary one-third rule. It is proposed to repeal the quality and testing of gas clauses in the Company's Order of 1886; and in lieu thereof to adopt a 14-candle standard and the "Metropolitan" No. 2 burner, with the Harcourt 10-candle pentane lamp as the standard. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

Further capital is required by the Llynvi Valley Gas Company; and £20,000 is the proposed limit to additional powers, with the proviso that the share capital shall not exceed in the whole £30,000. The new auction clause is included. The limit set to dividend is 7 per cent. on additional ordinary capital, and 6 per cent. on preference. The borrowing powers are not to exceed the amount defined by section 24 of the Act of 1868, and one-third on the additional capital. The Company also require the repeal of the existing illuminating power and testing clauses, and desire to conform to recent parliamentary practice in both regards. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Long Eaton Gas Company are asking for the transfer to them of the undertaking authorized by the Sandiacre Order of 1905. An extension of area is proposed; but the parish of Sandiacre is not to be deemed to be included within the additional limits of supply until after the date of the assignment to the Company of the Sandiacre undertaking. Supplementary land and works powers are included. Further capital sanction is sought to the amount of £45,000, to which the new auction clause is to apply. Dividend on the additional capital is limited to 5 per cent. Borrowing power in respect of the additional capital is proposed at the ordinary one-third. The special purposes fund clause appears. For a standard illuminating power of 14 candles, testing is to follow the modern method. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Musselburgh Gas Company have an extensive Order before the Scottish office for incorporation and bringing themselves into line with modern enactment. The Company have exhausted their capital and borrowing powers, and business is increasing. They therefore desire authority for supplementing capital, extending their works, and enlarging the facilities for the supply of gas. It is asked that the whole of the original shares of the old Company shall be converted into 30,000 ordinary £1 shares, bearing 5 per cent. dividend. The distribution of this converted capital is to be at the rate of thirty shares for every ordinary share of £15 entitled to a maximum dividend of 10 per cent. The preference shares are to be converted into 600 preference shares of £10 each, also bearing 5 per cent. dividend; and the distribution is to be twelve preference shares to every holder of a £100 preference share entitled to a dividend of 6 per cent. The capital of the Company it is proposed shall consist of £55,000 ordinary shares, and £6000 of preference shares. Of the former amount £25,000 will represent the additional capital, to which the new regulations referring to the issue of capital will be applied. Including £5000 borrowed by the old Company, borrowing powers are desired at the usual one-third rate. Reserve and special purposes funds are provided for. The standard price of gas is proposed at 3s. 9d. per 1000 cubic feet; and the sliding-scale is to apply on the ordinary terms. Power is requested to works extension on scheduled lands. A clause is inserted to empower differential prices; and the old form of discounts clause is included—proposing up to 10 per cent. for prompt payment, and 25 per cent. for large consumption or for power or heating. The prepayment meter clauses are included in the measure. It is in contemplation to reduce the standard illuminating power of the gas to 14 candles, tested according to modern rule. [*Parliamentary Agents: Messrs. A. & W. Beveridge.*]

Lady Laura M'Laren is the promoter of the Prestatyn Order [a Purchase Bill, it will be remembered, has been lodged by the Local Authority]. Her ladyship desires to be empowered to raise capital not exceeding £5000, on which a dividend of 7 per cent. may be paid on the amount "actually paid up," which is interpreted to mean (so long as the undertaking is carried on by an individual and not by a duly constituted company) the amount actually expended or used for the purposes of the undertaking. Borrowing power to the amount of one-fourth on the capital actually raised is desired. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Settle Gas Company, Limited, are desirous of possessing power to raise £7000 of fresh capital, applying thereto the new auction clause. The provision is attached that, until further authority is obtained, the share capital is not to exceed £15,000. The dividend is to be limited to 7 per cent. on the new capital issued as ordinary, and 6 per cent. on that issued as preference. Borrowing power only equal to one-fourth the amount of issued capital is sought. Further lands for manufacturing purposes are scheduled, for the purchase of which an agreement has already been effected. Authority to erect works on the new land is asked for. [*Parliamentary Agents: Messrs. Mellor and Co.*]

The Sutton and Hooton Gas Company, Limited, bespeak authorization for the extension of their operations. An enlargement of area is contemplated taking in the townships of Eastham

and Overpool. Further capital sanction is desired to the extent of £32,000, with the equivalent of one-fourth the amount issued as loan. On the new ordinary capital, the dividend mentioned is 7 per cent., and on the preference 5 per cent. The old form of auction clause appears. Permission to use certain acquired lands for manufacturing purposes is requested. Within the extended area of supply, a limit of price is proposed of 5s. 3d.; but the price so charged is to be subject to the provisions of the Order of 1892 fixing the price of gas with the sliding-scale as to dividend. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

The Ynyscynhaiarn District Council seek power to acquire certain scheduled lands for gas-making purposes, and to construct on them additional works. Several ordinary powers are included in the draft Order. The maximum price proposed for gas is placed at 6s. per 1000 cubic feet. It is arranged that separate records shall be kept of the gas supplied to private consumers and for public lighting respectively; and the price to be charged for public lighting is not to be less than that charged to private consumers for lighting purposes by more than 10 per cent. The raising of additional money is to be with the sanction of the Local Government Board. The greater part of the Order deals with financial matters. There is nothing new in them; they are merely to bring the Council under modern regulations in this regard. [*Parliamentary Agents: Messrs. Huntley and Son.*]

LOCAL GOVERNMENT FINANCE.

Local Taxation Returns Summarized.

THE total number of Blue-Books that have been devoted to setting forth the local rating statistics for the year 1905-6 is eight; the final one of the series (which was issued last month) consisting of a summary and index. The two sectional volumes which were of most general interest to our readers—namely, those referring to the accounts of the Borough Councils (outside the Metropolis) and the Urban District Councils—have already been noticed at some length in the "JOURNAL;" and now it is possible to note the total figures.

By way of introduction, it may be pointed out that the local authorities whose financial transactions during the year 1905-6 are summarized include all county councils, councils of municipal boroughs, councils of metropolitan boroughs, councils of urban districts other than boroughs, rural district councils, boards of guardians, the Managers of the Metropolitan Asylum District, the Receiver for the Metropolitan Police District, burial boards, harbour authorities not being commercial companies or private owners, parish councils, overseers, and other local authorities who are authorized to levy or order to be levied rates, taxes, tolls, or dues, within the meaning of the Local Taxation Returns Acts, 1860 and 1877. The total number of the authorities mentioned is 25,500—and that is counting only once those of them who made separate returns respecting their transactions in different capacities. Particulars of the sums received and expended by the Metropolitan Water Board during the year dealt with were published in a separate paper; and with one or two small exceptions, none of the sums received or paid on income account by the Board are included in the summary now under notice, as no part of their income had been received from "rates, taxes, tolls, or dues." The receipts quoted include the sums received by local authorities from Government grants towards the expenses incurred in respect of elementary education, as well as the gross receipts from water, gas, electric lighting, tramways, and other undertakings carried on by them, and miscellaneous receipts from rents and sales of property and repayments on account of work done for private individuals. Money borrowed to meet capital expenditure is treated separately. The expenditure included is, of course, such as has been defrayed out of the receipts mentioned. It may here be remarked that the number of local authorities who had expenditure (other than expenditure defrayed out of loans) during the year 1905-6 in respect of water supply was 1148, gas supply 214, electric light supply 242, and tramways and light railways 140.

The total amount of public rates collected in the year under review was £58,138,640, of which 25·5 per cent. was collected in areas in the administrative county of London. This total exceeded that for the previous year by £2,207,829, or 3·9 per cent. At March, 1905, the rateable value of England and Wales was, for purposes of poor rates and other rates levied in the same manner, £202,858,961, including £23,736,588 as the rateable value of agricultural land. The corresponding figures for the preceding year were £199,355,590 and £23,768,029. Calculated on the basis of the first-mentioned values, the total amount of the public rates received during the year 1905-6 was equivalent to an average rate of 6s. 1·2d. in the pound on dwelling-houses and other classes of properties which are rateable in proportion to the full rateable value. This is an increase of 1·4d. when compared with the year before. Calculated on the estimated population in the middle of 1905, the amount of public rates received was equal to £1 14s. 1d. per head, or an increase of 11d. per head over 1904-5. The Exchequer grants amounted to £19,849,983, or 1s. 11·5d. per pound of rateable value, and 11s. 7·6d. per head.

With regard to borrowings, the loans raised by local authorities during the twelve months amounted to £24,485,932; and leaving out of account, as being exceptional, the loans raised or taken over in 1904-5 by the Metropolitan Water Board, this was a falling off of some £9,000,000—the decrease affecting nearly every purpose, except schools, for which local authorities borrow. For water supply undertakings there was borrowed £4,359,221, or £1,831,545 less than in the preceding year; for tramways and light railways, £4,265,155, or £920,906 less; for electric lighting, £4,263,249, or £1,710,422 less; and for gas supply, £1,122,267, or £636,165 less. The increase during the year in the loans outstanding is £14,343,496, which it is pointed out is smaller than any annual increase that has been experienced between the years 1898 9 and 1905-6. Of the total amount received in loans in 1905-6, £10,463,657, or 42·7 per cent., was for baths, cemeteries, electric lighting, gas-works, harbours, docks, piers, canals, quays, markets, tramways and light railways, and water-works; £2,118,935, or 8·7 per cent., for elementary education, including industrial schools; £5,931,163, or 24·2 per cent., for highways, sewerage, and sewage disposal works; and £5,972,177, or 24·4 per cent., for other purposes. The total loans outstanding at March 31, 1906, amounted to £482,983,929—or excluding the exceptional sum borrowed by the Water Board, to £435,545,077; and of the latter, no less than £208,891,201, or 48 per cent., comes under the first group, including gas, water, electricity, baths, tramways, &c. Dividing the amount up, it is found that £23,716,522 is for gas-works, £71,389,889 for water-works (excluding £47,438,852 for the Metropolitan Water Board), £27,492,817 for electric lighting, and £28,137,434 for tramways and light railways. The average amount per pound of rateable value, over England and Wales, of the total loans outstanding is £1 5s. 3d. (including the Water Board loans) for undertakings which are revenue bearing, and £1 2s. 4d. for loans for all other works and purposes; the average amounts per head of the estimated population being respectively £7 10s. 1d., and £6 12s. 9d. The amount standing at March, 1906, to the credit of sinking and other similar funds applicable towards the repayment of such part of the outstanding loan balance of £435,545,077 as was repayable by means of those funds, was £16,409,031.

The total receipts of the local authorities in 1905-6, excluding loans, amounted to £113,717,976; and of this £20,298,691, or 17·8 per cent., was for gas, water, electric lighting, tramways, and light railways. Excluding any charge made by a local authority for water, gas, or electric current used by the authority for public purposes, the items are as follows: Gas-works, £7,073,249; water-works, £4,429,778; electric light undertakings, £2,853,537; tramways and light railways, £5,942,127. The total expenditure, excluding loans, was £111,339,748; some of the items of which are: Gas-works: Maintenance and other expenses, £5,082,726; loan charges, apportioned as far as practicable, £1,456,743; total, £6,539,469, or 5·9 per cent. of the total. Electric lighting (other than public lighting): Maintenance and other expenses, £990,886; loan charges, £1,713,415; total, £2,704,301, or 2·4 per cent. Public lighting: Maintenance and other expenses, £2,126,130; loan charges, £15,659; total, £2,141,789, or 1·9 per cent. Water-works: Maintenance and other expenses, £1,774,933; loan charges, £3,280,917; total, £5,055,850, or 4·5 per cent. Tramways and light railways: Maintenance and other expenses, £3,800,070; loan charges, £1,567,183; total, £5,367,253, or 4·8 per cent. of the total.

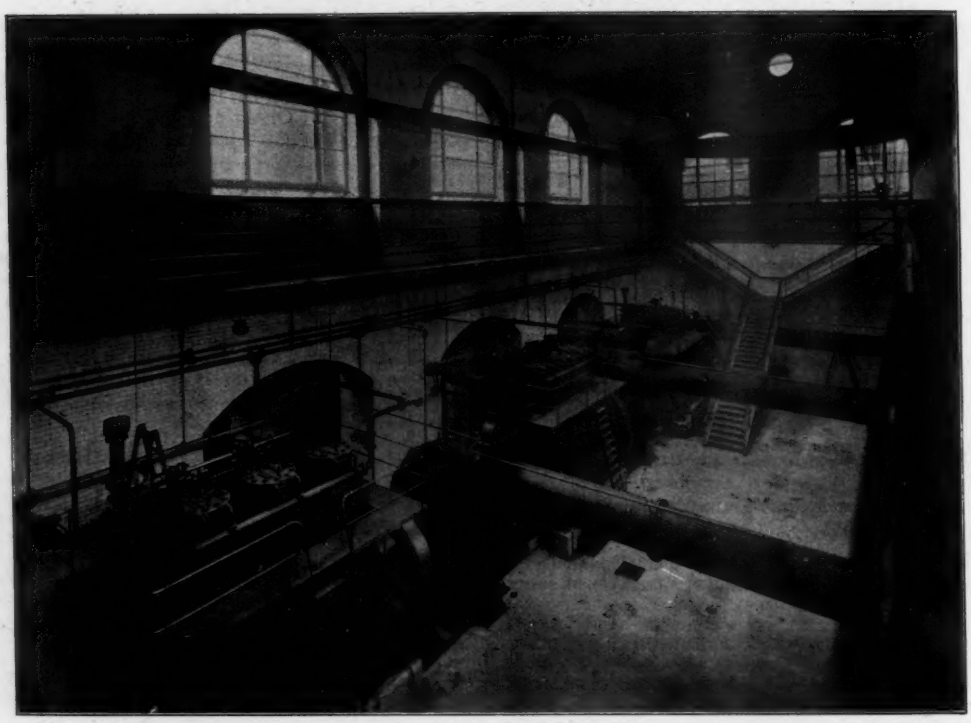
Manchester District Institution of Gas Engineers.—The annual meeting of the Institution will be held on the 27th inst., when the President-Elect, Mr. J. W. Morrison, of Sheffield, will deliver his Inaugural Address. The business of the meeting will include the reading of a paper by Mr. R. Watson, of Doncaster, on the "Make and Sale of Coke."

Connecting High-Pressure Steel Gas-Mains.—In the "JOURNAL" for the 19th ult., it was mentioned, in a paragraph on the above subject, that the Gaslight and Coke Company were strengthening the 6-inch Mannesmann steel tube running down Bouverie Street (a branch from the high-pressure steel main in Fleet Street) with a 3-inch collar, made of ¾-inch wrought iron, having on the top a ½-inch connecting piece. We learn that the Company have since decided to adopt the Parkinson and Woodall expansion nipple, which was described and illustrated in the "JOURNAL" for the 17th of November last (p. 502).

Society of Engineers.—The first ordinary meeting of the Society for the present year was held on Monday last week, at the Royal United Service Institution, Whitehall. Mr. J. W. Wilson, the President for the year 1908, occupied the chair at the opening of the proceedings, and presented the premiums awarded for papers read during the past session. He then introduced his successor—Mr. E. J. Silcock, of Westminster and Leeds—who delivered his Inaugural Address, in which he reviewed some of the more important features of municipal enterprise as affecting the engineering profession, and drew attention to the vast expenditure by local authorities during recent years on works of water supply, sewerage, sewage disposal, destruction of town refuse, roads, tramways, and the like. With reference to water supply, he pointed out the importance of utilizing to the full the available sources, and indicated the directions in which steps will in future probably be taken to secure this end. The recent introduction of bacterial systems of sewage purification, and the labours of the Royal Commission on sewage disposal, were touched upon, and the evolution of the modern refuse destructor was traced. Finally, the question of road construction and maintenance, in relation to modern motor traffic, was discussed.

LARGE TOWN-GAS ENGINE INSTALLATIONS IN SOUTH LONDON.

The Shad-Thames Pumping Plant of the London County Council.

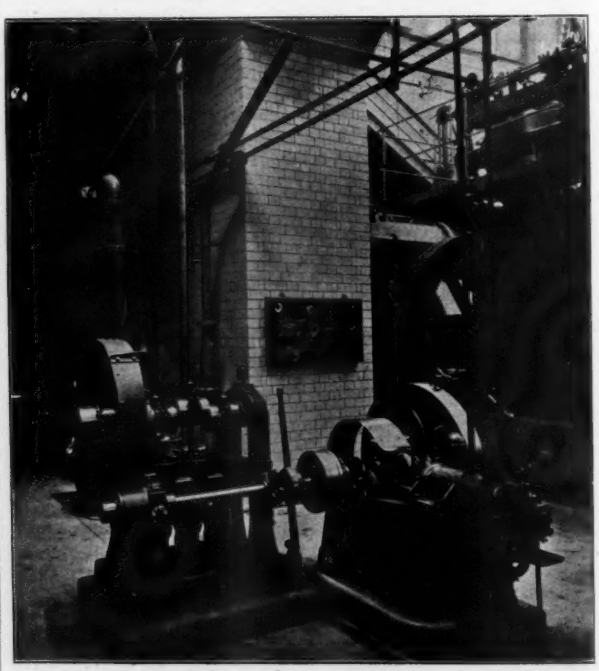


The Three-Cylinder Vertical Gas-Engines (350 H.P. each) at the Shad-Thames Pumping-Station of the London County Council.

THE report of the Directors of the South Metropolitan Gas Company for the past half year (published last week) brought to the notice of the proprietors the increasing use of gas for power and industrial purposes. Where town gas is cheap, there is bound to be progress in this direction, providing, of course, there is the scope in the local industries for the employment of driving and heating agents; and the coal gas of the South Metropolitan Company, with the discounts allowed from the ordinary price, is cheap having regard to its calorific value. The remark in the Directors' report as to the increasing popularity of gas for power and industrial purposes led up to a reference to the largest power installation completed in their area during the half year; and this installation is at the Shad-Thames pumping-station of the London County Council, where coal gas is supplied to pumping-engines of upwards of 1000-horse power. But this installation, measured by horse power, does not transcend all else that the Company have done in this way. There is an installation of Westinghouse gas-engines at the Surrey Commercial Docks, also practically of 1000-horse power; and this is used for supplying electrical energy for power and lighting for the docks. In this case, there are three engines—two being of about 450-horse power, and the third of about 100-horse power. Other considerable installations are running in the Company's extensive district of supply for manufacturing purposes, laundry work, and so forth.

The Shad-Thames pumping-engines, however, represent the latest considerable installation; and, by the kindness of the Chairman of the South Metropolitan Gas Company (Mr. Charles Carpenter) and the Chief Engineer of the London County Council (Mr. Maurice Fitzmaurice, C.M.G.) we are in a position this week to describe and illustrate the plant. The Shad-Thames pumping-station has been erected for the purpose of relieving the present sewage system, in the South-Eastern and South-Western districts of London, by pumping the water out of the sewers and delivering it into the Thames to the south of the Tower Bridge. The three gas-engines (which, as the photographs show, are excellent examples of work of their kind) were built by the Campbell Gas-Engine Company. They are of the three-cylinder vertical type, of 350-brake horse power each, and fitted for high-tension magneto ignition. They are started by auxiliary gas-engines (three in number, and each of 20-horse power), which are used for the purpose of compressing air into the cylinders. The engines are direct coupled to the pumps, which are of the centrifugal type.

The gas to the engines is supplied from the Rotherhithe works of the South Metropolitan Gas Company, through a 9-inch main specially laid for the purpose. A minimum pressure of 10 inches is maintained on the main from the gasholder. A small but interesting feature of the installation is found in the governor-house at Rotherhithe. There a Cowan governor is fixed on to the 9-inch main. Attached to the governor is a small tappet; and fixed on a runner is another tappet, which is connected to an electric bell. Now, when the engines are started up, there is a momentary fall of pressure in the 9-inch main; and electrical connection being made at the governor, the electric bell rings—notifying to the man in charge the fact that the engines have started working. At 10 inches pressure, the main is of ample capacity for supplying the quantity of gas that the three engines require, which is about 6500 cubic feet per hour each, at full load. It is understood that it is the intention of the London County Council at some future date to put down three additional engines of equal power; and then the 9-inch main would not be of sufficient capacity to supply all the gas required, if only 10 inches pressure were maintained. But arrangements have been made in the governor-house for connecting the 9-inch main to the fans which are used for boosting gas from Rotherhithe to the Old Kent Road station. These fans maintain a pressure of something like 22 inches. Therefore,



One of the Starting-up Plants.

at any future time the delivery of the main can be increased by raising the pressure from 10 inches to 22 inches directly the electric bell warns that the engines are at work. The 9-inch main, it should be mentioned, is governed in the engine-house at the pumping-station; the pressure being reduced to 2½ inches. The consumption of gas is registered by three 1200-light wet meters of the station type.

It is interesting to observe that the London County Council have seen advantage in adopting for driving these engines ordinary coal gas on the normal power terms hitherto existing in the South Metropolitan Company's district. The gas is paid for at the rate of 2s. 3d. per 1000 cubic feet, less a discount of 5 per cent. on 5 million cubic feet, 6 per cent. on 6 millions, and so on—rising 1 per cent. per million cubic feet to 10 per cent. for 10 millions per annum. The immediate availability of coal gas for an installation such as this, and for such a purpose, has a value that cannot be procured with the best of producer-gas plants.

FERRO-CONCRETE CONSTRUCTION ON A GAS-WORKS.

THERE are to be seen at the Poole Works of the Bournemouth Gas and Water Company some excellent examples of ferro-concrete construction on the Hennibique system—as will be gathered from the accompanying illustration of the main block of buildings. These buildings, it may be recalled, were put up some three years ago, to the design of Mr. Harold W. Woodall, the Engineer and General Manager of the Company; and after the concreting work was completed, the whole was painted with one wash of ordinary cement. The buildings are perfectly sound, and show no signs of the small cracks that were at one time liable to be found rather troublesome in the case of concrete work of this kind. The panels are only 6 inches thick; but neither through them nor through the roof has there been the faintest sign of leakage; and the buildings are very warm and comfortable.

On the right of the photograph is the settling tank, into which the whole of the water used for the ordinary supply of the works is delivered. This water is pumped by compressed air from the running sand by means of a bore 300 feet deep, and is used for the whole of the works purposes, including the boilers. For drinking purposes, there is a separate supply from the Corporation mains. The water from the borehole is slightly acid; and it is found necessary each day to place a small quantity of lime in the feed-water tank. This lime forms a very fine scale on the boilers, and entirely protects them from the corrosive action of the water. There is no trouble in cleaning the boilers; and the interior metal surface is now as good as on the day they were started up.

The first building in the photograph is the power-house, the second contains the carburetted water-gas plant, third is the boiler-house, and the building the top of which is only just visible is occupied by the sulphate plant. The bridge which can be seen between the coke-heap and the water-gas house is used for taking coke from the hoppers to the water-gas plant and breeze from the hoppers to the boilers.

Mr. Alexander Glen, K.C., on Local Government Law.

On Friday, the 29th ult., Mr. J. H. Menzies, Barrister-at-Law, delivered the first of a series of lectures on "Municipal Law" at the London School of Law, Old Serjeants' Inn, Chancery Lane. The subject of the introductory lecture was a historical review of English local government. Mr. Alexander Glen, K.C., presided, and in the course of his introductory observations pointed out that continuity was the key-note of English local institutions. He said our local affairs to-day were administered by almost exactly the same authorities as those who administered them in Saxon and Mediæval times, though their constitution had altered with the changes in the spirit of our national government, and their functions had been greatly enlarged. There had been adaptation and expansion, but not any starting afresh with brand-new institutions; the old ones having sufficient vitality and elasticity to be altered to suit new conditions. There had been evolution but not revolution. From the synopsis of the lecture, he noticed that the lecturer considered that Queen Elizabeth was the originator of the present system of local rates. This statement was substantially correct; but a pedant might take a technical objection to it. At common law, vestries had the power of levying a rate for local purposes, and no Statute had ever deprived them of it, obsolete though it now was. He wondered what would happen if some vestry took a fancy to exercise this right, disused for more than three centuries, and suddenly levy a rate. He hoped the series of lectures would be a success. In these days, when local authorities had such vast powers, when their officials, clerks, and employees were so numerous, it was well that the latter should thoroughly train themselves for their duties. Mr. Menzies then proceeded to deal with the great divisions of local life in England—the shire or county, the hundred or district, the tithing, manor, borough, parish, and union. He traced their history in varying forms throughout the Saxon, Norman, Tudor, Hanoverian, and Victorian periods of our history, and showed how the changes in the national constitution had synchronized with similar changes in the character of the governing bodies in local affairs. The Saxon period had democratic self-government of a direct, not representative, type. This was replaced by feudalism in the Norman period, and by a system of Crown Nominees in the Tudor period. The latter system was added to by the creation of a bewildering and chaotic multiplicity of Boards of Trustees in the Hanoverian Age; while the democratic era, ushered in by the first Reform Act of 1832, led to the reconstruction of local government on the lines of democratic representative government.

The London and Southern District Junior Gas Association will pay a visit to the works of the Lea Bridge District Gas Company next Saturday. It is proposed to assemble at the works entrance about 3 p.m.

Wedding of Mr. W. D. Child, of Romford.—On Saturday last, Mr. W. D. Child, the Engineer and Manager of the Romford Gas-Works, was married at St. John's Church, Chelsea, to Miss Constance Jessop. The ceremony was followed by a reception and breakfast at the Trocadero Restaurant.

A Gas-Operated Dredger.—According to a paragraph in the "Engineer," a gas-operated dredger has been built for large drainage canal work in Iowa. The machine is of the ladder type, the buckets delivering the spoil to two pan conveyors, which deposit it on the banks of the canal. The engine is of 150-H.P., and pea-sized anthracite coal is used in the producer. The system was adopted on account of the difficulty of transporting fuel. The machine works on 2 tons of coal per 24 hours; the dredger running 20 hours.

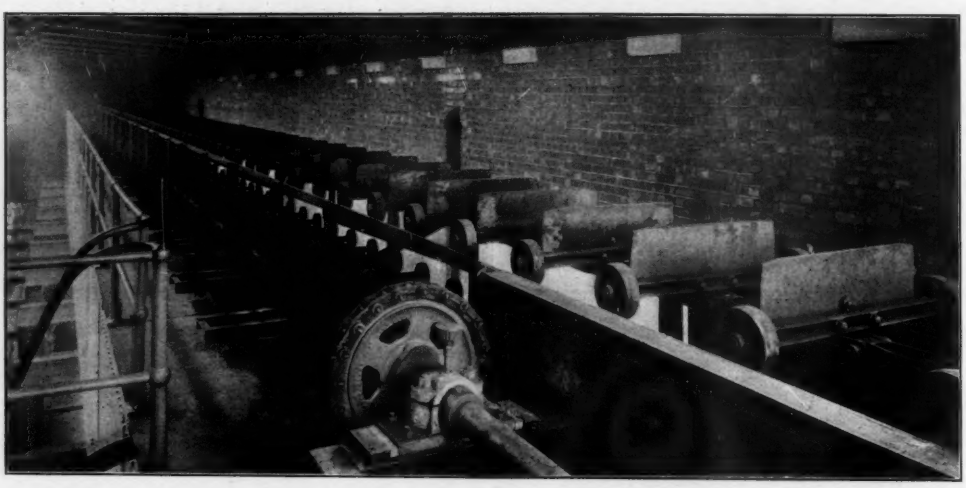
Scottish Junior Gas Association.—The Eastern District of the Scottish Junior Gas Association are to visit next Saturday the Meter-Works in Buccleuch Street, Edinburgh, of Messrs. Parkinson and W. & B. Cowan, Limited. During the afternoon, Mr. Gordon, Inspector of Gas-Meters for the Corporation of Edinburgh, is to keep the testing department open for the inspection of the visitors. The Western District hold a meeting in Glasgow in the evening, at which Mr. G. H. M'Cowat, Assoc.M.Inst.C.E., of Glasgow, is to read a paper entitled "Distribution of Gas: Main Laying."

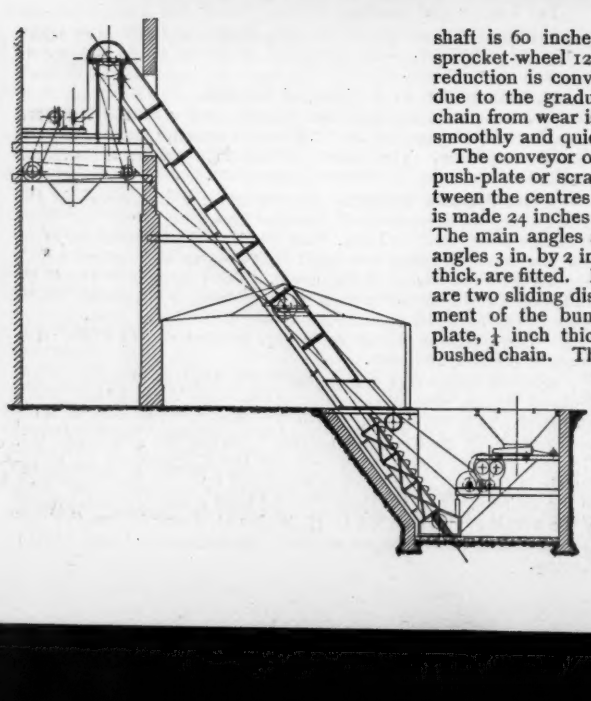
COAL-HANDLING PLANT AT THE DERBY GAS-WORKS.

MANY of our readers are doubtless aware that during the past two years considerable alterations and extensions have been made at the various works of the Derby Gas Company, under the superintendence of Mr. J. Ferguson Bell, M.Inst.C.E., the Engineer and Manager. Last winter, No. 1 retort-house at the Litchurch works was completely equipped with machinery and coal bunkers to serve the existing horizontal retorts, and hand charging was abandoned. The results obtained were so gratifying that during the succeeding autumn the roof of the second retort-house was raised 20 feet, new regenerative retorts were put in, and the house was rapidly furnished with the most approved plant. In the accompanying illustrations are shown the fine coal elevator and conveyor erected by the Chain-Belt Engineering Company, of Derby, to fill the new overhead storage bunkers with broken coal at the rate of 50 tons per hour. The plant, which is driven by a "National" gas-engine, presents several novel and interesting features.

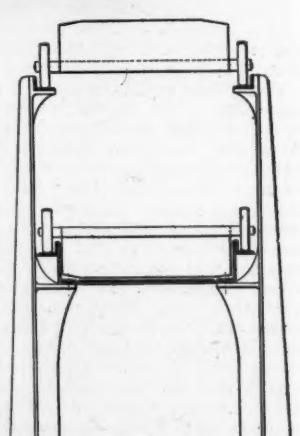
The run-of-mine coal is discharged from railway waggons into a receiving hopper by means of a belt-driven tipper, and is reduced to the required size in passing through a four-roll coal-breaker by Messrs. W. J. Jenkins and Co., Limited. The breaker is fed by a jigging or reciprocating feeding-shoot. The coal-elevator is of 80 feet centres, and is fully cased. The buckets are 18 inches long with thickened lip, made of Ley's "Blackheart" malleable iron, and are pitched 18 inches apart. At the back of every alternate bucket, there is a forged steel cross-bar, with turned ends, on which revolve rollers 6 inches in diameter, fitted with special self-lubricating bushes, requiring no oil. The roller-path has renewable wearing strips.

The buckets are bolted to a heavy chain of the Ley bushed type (No. 6140), of 6-inch pitch; the bearing service of the pins being $\frac{7}{8}$ inch diameter by $4\frac{1}{8}$ inches, and the hardened steel bushes renewable. The main sprocket-wheel, 24 inches diameter, is made of chilled "Blackheart" metal, and keyed on to a top shaft $4\frac{1}{2}$ inches diameter, turned down to 4 inches at the journals. This revolves in flexible roller bearings, so that the friction is reduced to a minimum. There is no head gearing. The top shaft is driven direct by a Ley frictional grip chain, which forms one of the novelties of the plant. The grooved toothless wheel on the top shaft is 60 inches in diameter, and the driving sprocket-wheel 12 inches diameter. Thus a large reduction is conveniently obtained, while trouble due to the gradual increase in the pitch of the chain from wear is avoided. This drive runs very smoothly and quietly.





The conveyor over the storage bunkers is of the push-plate or scraper type, and is 110 feet long between the centres of the end wheels. The trough is made 24 inches wide, and has the section shown. The main angles are 6 in. by 3 in.; and the guide angles 3 in. by 2 in. Renewable liner plates, $\frac{1}{4}$ inch thick, are fitted. In the bottom of the trough there are two sliding discharge doors over each compartment of the bunker. The scrapers are of steel plate, $\frac{1}{4}$ inch thick, bolted to a 6-inch pitch Ley bushed chain. The malleable iron cross-bars carry rollers 6 inches in diameter, fitted with self-lubricating bushes. A wrought-iron access ladder and a roomy chequer-plate platform are provided.

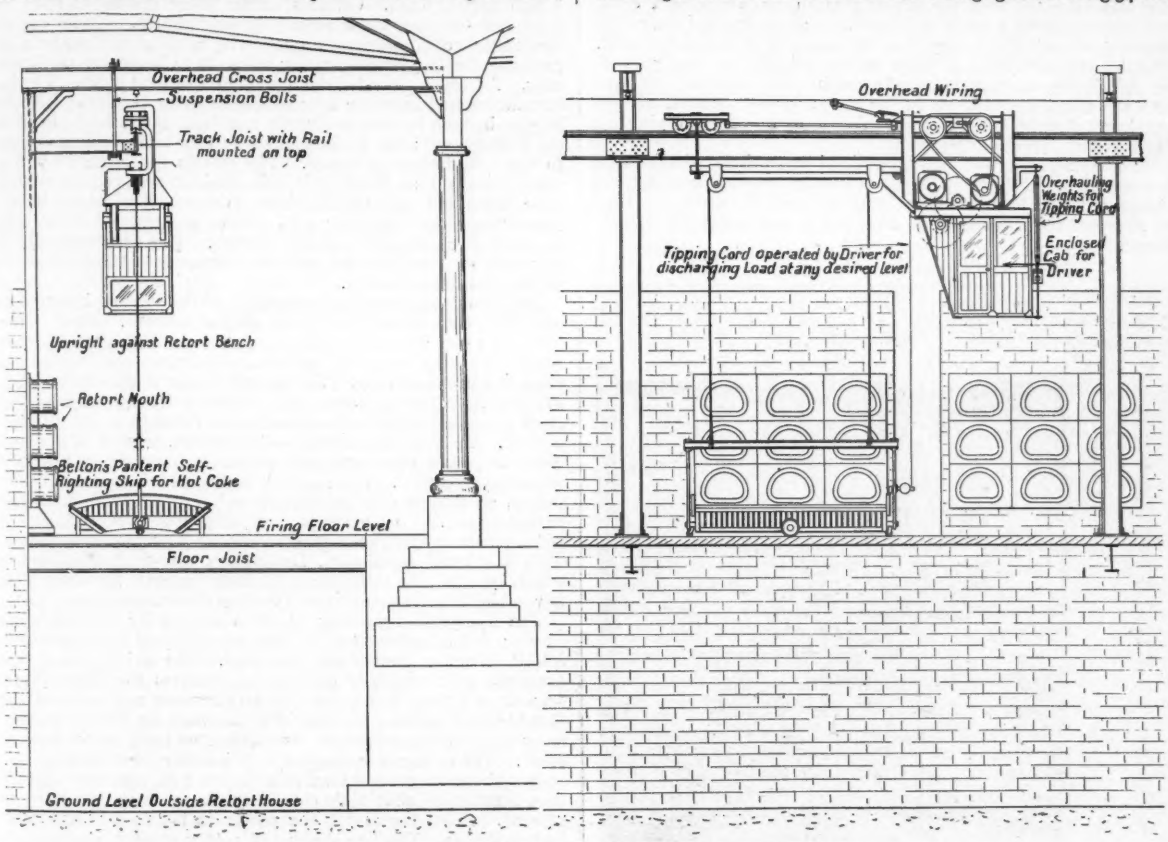


The continuous storage bunker serving the electrically driven De Brouwer charging-machine measures 105 feet long, 10 feet wide, and 8 ft. 6 in. deep; its total capacity being 132 tons. It is divided into eleven compartments—one to each bed of retorts—each being fitted with two outlet doors, worked from the charging-machine.

COKE-HANDLING PLANT AT THE KEIGHLEY GAS-WORKS.

THE coke-handling plant recently erected at the Keighley Gas-Works was installed for the purpose of handling the hot coke direct from the retort and conveying it from the retort-house, quenching, and depositing it in coke-hoppers for screening purposes, or directly on to a large storage heap. Before deciding on the actual plant to be installed, Mr. John Laycock, the Gas Engineer and Manager, with his Chairman and Committee, inspected installations of various types; and after an examination of the telpherage plant at the works of the Newport (Mon.) Gas Company, it was decided to instal this system at Keighley. Various schemes were submitted by contracting firms, and the arrangement sent in by Messrs. Strachan and Henshaw, of Bristol, was selected, and the contract placed with them. The installation consisted of a gas-engine and direct-coupled generator, switchboard and wiring, electric telpher, with 820 feet of telpher track, Belton's patent coke-skips, coke-hoppers, rotary screens, and coke-breaker. The contracts for the coke screens and hoppers and the generating plant and motor were sublet to Messrs. Robert Dempster and Sons, Limited, of Elland, and Messrs. Siemens Bros., Limited, respectively.

The telpher was arranged to handle the coke direct from the retorts to the screens and coke heap in the following manner: A line of telpher track was installed along the full length of the retort-house, at a height of 18 ft. 6 in. above the level of the firing-floor, with the centre line of the track joist 5 ft. 6 in. from the retort faces. The length of the track inside is 340 feet, and it extends along the entire run of the benches; the total number of retorts being 81, in beds of nine. Outside the retort-house the telpher track is extended up to and over the coke-hoppers, a further distance of 116 feet. After passing over the hoppers, the track curves to the left with a radius of 40 feet, and then runs back over the coke-storage ground, practically parallel to the hoppers, for a distance of 200 feet; the total length of the track being 820 feet. The ground level outside the retort-house is 11 ft. 2 in. below the firing-floor; and the height of the track above the ground level outside is 35 feet. This allows of the telpher passing over the top of the screens, and discharging coke into the hoppers; the height of the track above the top of the hoppers being 10 ft. 6 in. The height of the track inside the retort-house, at the centre, being limited to 18 ft. 6 in. above the firing-floor, owing to obstructions overhead, it was necessary to run the telpher track at a gradient of 1 in 30 from the centre of the house up to and over the screens, in order to attain the necessary height of track for the telpher to pass over the hoppers. The height of the track over the coke-storage ground being 34 feet


Overhead Cross Joist
Suspension Bolts
Track Joist with Rail mounted on top
Upright against Retort Bench
Retort Mouth
Belton's Patent Self-Righting Skip for Hot Coke
Firing Floor Level
Floor Joist
Ground Level Outside Retort House
Overhead Wiring
Overhauling Weights for Tipping Cord
Enclosed Cab for Driver
Tipping Cord operated by Driver for discharging Load at any desired level

The General Arrangement of the Telpher Plant in the Retort-House.

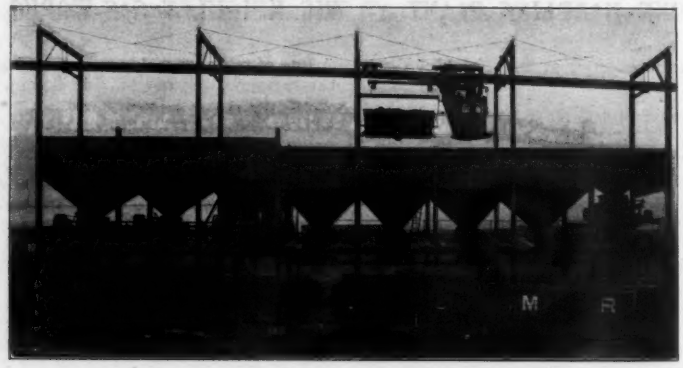
and the length of the ground 260 feet, a total storage capacity of about 2500 tons of coke was obtained.

The telpher track is arranged on Messrs. Strachan and Henshaw's single-track mono-rail principle. It is made up of 12-inch by 6-inch rolled steel joists, on the top of which is mounted, by means of hook bolts, a small renewable track rail 3 inches high, which forms the actual running rail for the telpher travelling wheels. This track joist is supported every 20 feet by overhead cross joists in the retort-house, and strong lattice-legged trestles outside. The web of the joist is bolted to 6-inch by 3-inch track arms; the other end of the arm being bolted to one leg of the trestles or to uprights in front of the retort-benches. The arm is then slung, by means of long suspension bolts, from the overhead cross joists in the retort-house, and short overhead cross-joists supported on top of the trestle uprights. Where the telpher track is carried over the coke-hoppers, the trestle legs are also arranged to carry the hoppers and the screens; the legs being strengthened for the purpose.

The electric telpher for handling the loads is one of Messrs. Strachan and Henshaw's standard two-motor machines—one motor for hoisting and the other for travelling. The telpher is capable of handling gross loads of 30 cwt. at a maximum hoisting speed of 60 feet per minute, and a maximum travelling speed of 500 feet per minute. The travelling motor is arranged to drive the telpher travelling wheels by means of a triangular chain drive. The motors are controlled by a single-crane type controller, which is arranged to operate either motor by means of a change-over switch. The main switch and fuse are mounted in the driver's cage, so that the machine is entirely isolated.

The skips for carrying the hot coke were constructed by Messrs. Dempster in accordance with Belton's expanding lattice patents; the bottoms being fitted with small trolley wheels to facilitate moving them about on the firing-floor. There are two types supplied—skips of standard design for handling the coke from all the retorts except the bottom row, and extra shallow ones for dealing with the coke from the bottom row only—the capacities being 18 cwt. and 15 cwt. respectively. For quenching the hot coke, a steel water-tank is carried on brick piers just outside the retort-house and at the level of the firing-floor; the coke being quenched by immersing the whole skip in the tank.

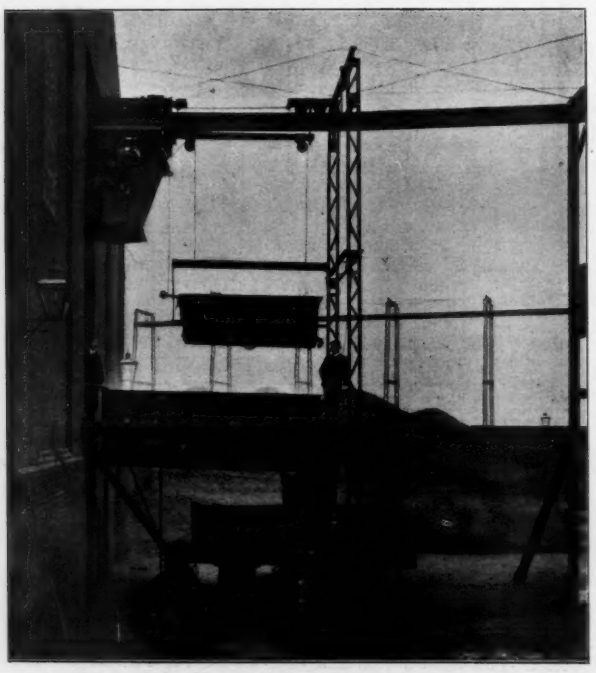
The coke is handled as follows: The telpher deposits empty skips close alongside the retorts, and the mechanical pusher discharges the contents of three retorts into each skip. The driver then hoists a load of hot coke and travels with it out of the retort-house to the quenching-tank, where he lowers it into the tank. The load is then hoisted again, and is conveyed to the hoppers or round to the storage heap and discharged as required. The discharging of the load is under the control of the driver from his cabin, and is arranged as follows: The skips are fitted with lifting trunnions at the ends, which are attached to the lifting-hooks of



Arrangement of Telpher delivering Coke into the Coke Hoppers. Showing the Arrangement of Rotary and Shaker Screens, Breakers, &c.

the telpher. They are so balanced that they are self-tipping when full and self-righting when emptied. At the end of the skip is fitted a suitable catch, which holds the skip in position. This catch is released from the driver's cabin by means of a cord, which passes over a set of pulley-wheels at the back of the cabin, and is overhauled and kept tight by means of a balance-weight. The driver can thus tip the load at any height from the ground, by pulling the cord; and the coke can be discharged on the heap with the skip lowered close to the coke stack—thus avoiding the breakage of coke and the accumulation of breeze by giving an unnecessary fall on to the heap.

The telpher plant will handle one load every three minutes, and is generally a duplicate of that supplied by Messrs. Strachan and Henshaw to the Newport Gas Company, with the exception that at Newport the telpher is not arranged to run inside the retort-house.



Telpher Hoisting Coke out of the Quenching Tank.

The generating plant consists of a 33½ B.H.P. National gas-engine, with self-starter, direct coupled to a Siemens compound-wound 220-volt generator, giving an output of 19·5 kilowatts running at 250 revolutions per minute. The switchboard is equipped with a generator panel and two feeder panels—one being for the telpher circuit and the other for the screen-motor circuit. The panel is also arranged with a suitable change-over switch for connecting up another generating set in the same power-house, for supplying current to the charging-machines, &c. In the event of a breakdown to either generating set, the main current can be transferred from one generator to the other as desired.

The coke-screening installation was designed and manufactured by the Sub-Contractors (Messrs. Robert Dempster and Sons), and arranged to suit Mr. Laycock's and Messrs. Strachan and Henshaw's requirements. It consists of a continuous set of overhead coke-hoppers, into which the telpher delivers the coke from the retort-house. These hoppers have a capacity of 80 tons, and are divided into eight separate compartments. Under the first (nearest the retort-house) is an adjustable sliding tray feed, which delivers coke in a regular stream to a coke-breaker having adjustable rollers so that the size of coke can be varied to suit requirements. From this breaker it is delivered down a shoot to a revolving perforated screen having two sizes of holes—viz., ⅜ inch and 1⅜ inch. On this screen three grades of coke are produced—breeze, small screened, and tailings. Under each of the next four compartments are revolving screens (without breaker) perforated with ⅝-inch diameter holes, so as to extract the breeze only. All these screens are made with a central shaft. The last four mentioned have the coke supply to them regulated from the hopper bottom by means of short cast-iron spiral feeds fixed on the screen shaft; the feeds working in cast-iron troughs secured to the coke-hopper bottoms. The spirals revolving as part of the screen act as feeds to it, and prevent any sudden rush of coke being fed into the revolving screens, all of which have a capacity for easily dealing with 5 tons of coke per hour when rotating at 20 revolutions per minute. The screened coke or breeze from each may be delivered direct into trucks standing on parallel lines or carts.

The remaining three compartments of the storage hoppers are provided with three jigging or shaker screens. Each screen frame is 3 feet wide and 13 feet long and is fitted with a screening area 6 feet long and 3 feet wide, having zigzag slot holes ⅜ inch wide and 2 inches long. The screen frame is strung by forged hangers from the structure, and is driven from a forged crank-shaft giving a 5-inch stroke, to screen at the rate of 100 strokes a minute. To avoid any shock to the screen, as well as to economize the power absorbed, each screen is balanced by a suitable weighted fly-wheel. Each screen is driven off a fast-and-loose pulley, so that it can be started and stopped as desired, thus saving power. To ensure perfect screening, it is necessary to regulate automatically the quantity of coke passing over the screen. This is effected by Messrs. Dempster's sure-feed arrangement, which consists of a sliding tray working beneath the hopper outlets, which regulates the rate of feed to the screens.

The complete screening plant is driven by electric motor power; and in order to avoid the possibility of breakdown, two 8-H.P. Siemens motors are provided. The driving gear is so arranged that normally one motor actuates the three jigging screens and the other the five rotary screens and breaker; but should either motor give trouble at any time, by simply pulling a lever one can be coupled to drive either or both sections of the plant. The motors are situated in a weather-proof housing supported above the ground level so as to give a cartage way beneath; thus leaving an absolutely clear way for carts to and from the screens. From the motor the power is led to the line shafts by belt drives. The line shafts and rotary screens are provided throughout with Hyatt roller bearings and ball thrust bearings to reduce to a minimum the power required. The line shaft is fitted with a clutch gear at each screen, so that any screen can be run independently of the others.

The complete screening plant is built into the uprights carrying the telpher track. The screens deliver direct into the gas-works trucks or carts beneath; and it will be observed that the screens are sufficiently close together to allow any two screens to deliver into one truck, so that a truck can be loaded in a very few minutes. Ample platform accommodation has been arranged at the levels of the screens, to facilitate access.

"Butterworths' Workmen's Compensation Cases."—We have received the first volume of a proposed series of reports, to which the above-named title has been given. It is a continuation, in an amplified form, of the volumes edited by the late Mr. R. M. Minton-Senhouse, and contains reports of cases decided under the Workmen's Compensation Acts between September, 1907, and August, 1908. All the Scottish and Irish decisions have been included for the first time; and a selection of the more important decisions on the subject of workmen's compensation pronounced by the High Courts of Canada is given in an appendix. The volume, which will be more fully noticed in a subsequent issue, has been produced under the joint editorship of his Honour Judge Ruegg, K.C., and Mr. F. J. Coltman, of the Inner Temple and Midland Circuit. It is published by Messrs. Butterworth and Co., of Bell Yard, E.C., at the price of 7s. 6d.

A NEW DEVELOPMENT IN GAS HEATING.

The Méker Patent Burners and Furnaces.

By Wilfrid S. Peake, B.Sc.

The many advantages which gas possesses over coal or coke as a means of heating are being increasingly recognized on all sides. The ease with which its rate of combustion can be controlled, the absence of dirt or smoke which accompanies its use, and the concentration of heat it renders possible, together with its general adaptability, are some of its most striking advantages. Yet, there is another side to the question; and one of the arguments against the use of gas for many heating purposes is that of its cost. Undoubtedly, in the case of coal gas, this objection is often perfectly justifiable; and it is therefore of the greatest importance that the burners in which the gas is used should be designed to give the most efficient results possible. This is practically equivalent to stating that the burners should give the hottest flame possible; for the rapidity with which heat is transmitted from one body to another depends directly upon the difference of temperature between them. Practical considerations also demand that the temperature at all parts of the flame should be as uniform as possible; otherwise irregular expansions and consequent strains are set up in the vessel or body being heated.

Granted, then, that our ideal flame is to be intensely hot and also homogeneous, how is it to be obtained? Consider for a moment what is the chief aim of an engineer when he is designing a gas-engine. It is to so proportion the size of valves and passages that at the end of the compression stroke the compression-chamber is full of a homogeneous mixture of gas and air in the proportions necessary for perfect combustion—that is, about six parts of air to one of coal gas. Then when the mixture is ignited, the conditions are all favourable, and the maximum efficiency possible with the engine may be expected, provided that the exhaust gases are quickly disposed of, and the cycle is repeated with the least possible delay. Our ideal burner will fulfil somewhat similar conditions. In it the gas and air must first be mixed thoroughly and in the correct proportions for complete combustion. Then, having reached the appointed place, they must rapidly combine and pass off the field of action as quickly as possible, to make room for the new unburnt mixture.

The bunsen burner, though it has proved its real worth through many decades, and is conceived along truly scientific lines, falls short of our ideal. In it the proper proportion of air to gas, which, as has been pointed out, is about six of air to one of coal gas, cannot be obtained. Actually about two-and-half parts of air to one of gas are the proportions usually existing in the bunsen burner chimney; and if one attempts to increase the proportion of air, the mixture becomes explosive and the flame instantly fires-back. The result is that more air is necessary for complete combustion; and this can only be obtained on the outside of the flame. This accounts for the cold cone which is so noticeable in the centre of the ordinary bunsen flame, and the irregular distribution of temperature throughout the flame. The combustion being less rapid, and taking place over a greater area than it would if a perfect mixture were being burnt, the maximum temperature of the flame is not the highest possible. Attempts have been made from time to time to secure a more nearly perfect mixture of air and gas, and yet to avoid back-firing, by modifying the design of the bunsen burner. An important part of these modifications has usually been the addition of wire gauze to prevent back-firing; but only moderate success has attended these efforts, for the reason that to prove satisfactory the gauze must be of a fine mesh, and it then throttles the mixture considerably. Thus, what has been gained in improving the proportions of the mixture, has been lost by the consequent reduction in speed; so that in some cases it has been found desirable to largely increase the pressure of the gas in order to keep up the speed. But, in any event, the use of wire gauze is objectionable, since it easily becomes choked with dust, and is liable to corrosion.

Some few years ago, a French Chemical Engineer, M. Méker, determined to design a burner which should closely approach the ideal; and after many systematic experiments, and much painstaking and persevering work, during which time a great variety of burners (enough to start a small museum) were made and tested, his efforts were rewarded with success. A sectional view of the final type adopted is shown in fig. 1. It will be seen that the gas enters at the bottom of the burner in the usual way; but the air inlet-holes are much larger than usual, and the mixing-chamber or chimney is of a special shape, somewhat resembling an injector. By this means, the gas and air are caused to thoroughly mix in the proportions necessary for complete combustion; and the mixture ascends at a great speed. The essential feature of the burner is, however, what M. Méker calls the "cloissonnage" fitted at the mouth of the burner to prevent back-firing. This is a deep grid built up of thin strips of nickel, and is in appearance somewhat like a honeycomb, excepting that for simplicity in construction the cells are of square section. This nickel grid completely covers the mouth of the burner, as will be seen by the plan in fig. 1; and each of the square channels formed measures 2 mm. square, and is 10 mm. deep. The fact that this grid is so successful in preventing the flame from gaining entrance to the highly explosive mixture in the mixing-chamber or chimney, is because a flame has great difficulty in travelling in a direction opposite to the movement of the gaseous mixture which gives rise

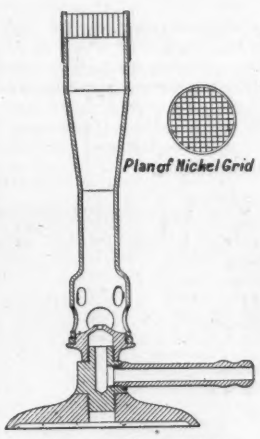


Fig. 1.—Ordinary Méker Burner.

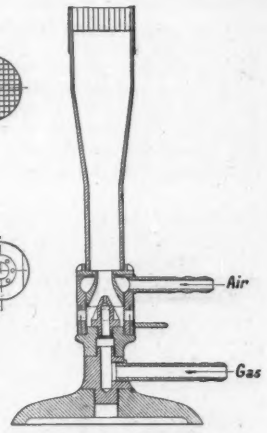


Fig. 3.—Méker Burner for Use with an Air-Blast.

to it; if in this inverse direction it encounters a very large cooling surface. Since the grid is of such an open mesh, it has practically no throttling action on the mixture; and being made of nickel, it has great power of resisting oxidation or chemical action, and therefore a long life. Also, it acts to some extent as a regenerator of heat, since the heat which is absorbed by the upper surface in contact with the flame is conducted downwards and given up to the cold gaseous mixture as it rises up the channels. The grid is thus always kept at a comparatively low temperature; so that if, accidentally, molten matter falls on it, it is immediately solidified without penetrating the interior, and can be readily removed after cooling.

The flame given by the Méker burner is quite novel in appearance and unique in its characteristics. At the top of each channel in the grid a small cone about 2 mm. high is visible, but above this is a solid cylinder of flame intensely hot. Experiments with a thermo-couple have shown that the temperature at all points in the flame is practically the same, and is higher than the highest temperature found in the ordinary bunsen flame. If a thick copper wire be held in the flame, it is quickly melted.

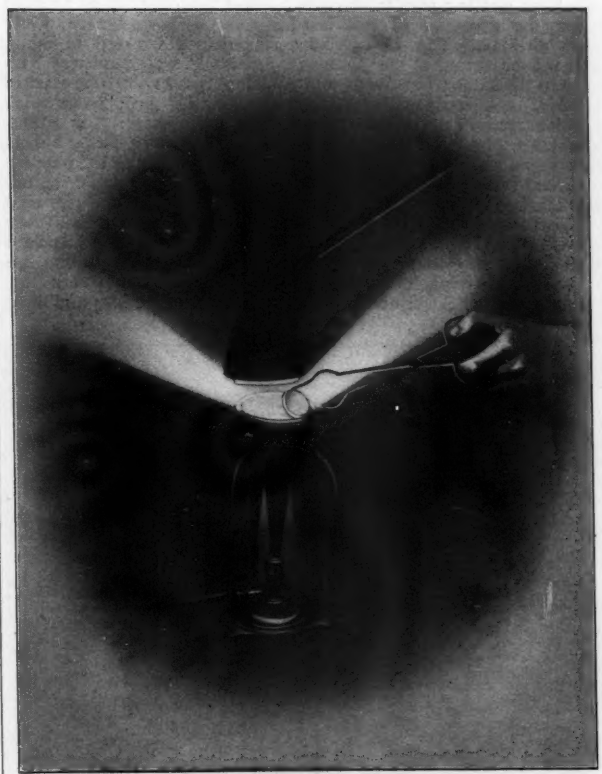


Fig. 2.—Small Crucible Furnace for Melting Copper, &c., without an Air-Blast.

In 1907, a Committee appointed by the Société Technique de l'Industrie du Gaz en France carried out some tests with the Méker burner, one of which consisted in heating a certain quantity of water to the boiling-point, first with the Méker and afterwards with the bunsen burner. The result showed a saving in gas consumption of 26·5 per cent. and a saving in time of

18·7 per cent., both in favour of the Méker burner over the ordinary bunsen burner. A second test, the object of which was to keep a crucible at 1060° C., first with an ordinary burner using an air-blast, and secondly with a Méker burner not requiring any air-blast, resulted in a saving of about 50 per cent. in gas consumption for the Méker burner, with, as an additional advantage, less labour for the operator and greater regularity of temperature arising from the discarding of the air-blast.

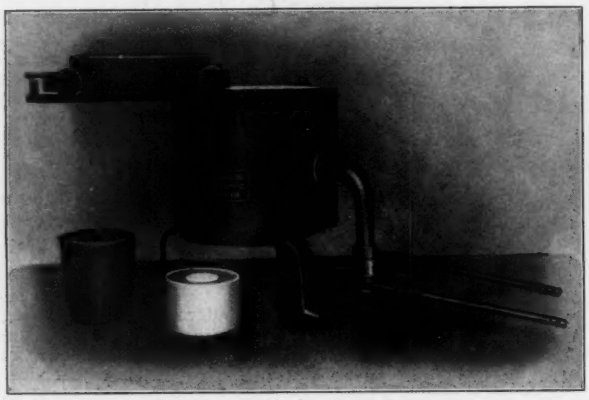


Fig. 4.—Crucible Furnace, with Air-Blast.

Naturally, interesting results are to be expected when such a burner is applied to furnaces, though it should be noted that, owing to the special proportions of gas and air it uses, it is not satisfactory to simply substitute it in place of other burners, but it is essential that the furnace be specially designed for use with the burner if the best results are to be obtained. Fig. 2 illustrates a small crucible furnace designed by M. Méker, in which silver, gold, and even copper can be melted; no air-blast being necessary. The crucible is supported on three small fire-clay dovetail pieces. This furnace has been found exceedingly useful by jewellers and in metallurgical laboratories. Special muffle and tube furnaces have also been designed, in which temperatures up to 1200° C. can be obtained, also without any air-blast.

Such striking results at once suggest the question as to what may be expected of this burner when it is designed to use an air-blast. The burner so designed is illustrated in fig. 3. It will be seen that the mixing-chamber and "cloissonnage" remain the same; but the air-blast itself enters by the tube marked "Air," and escapes into the mixing-chamber through six small holes arranged concentrically round the gas-injector. Fig. 4 illustrates a crucible furnace in which the flame from a Méker burner using an air-blast is made to circle round the crucible in screw-thread fashion. The fire-clay block on which the crucible stands is marked A, and B is the plumbago crucible used. The next illustration (fig. 5) shows this same crucible after it has been heated in the furnace. The intense heat to which it has been subjected is evident, for the clay used in its construction has boiled out, giving it the appearance of being coated with barnacles. Four Seger cones were placed in the crucible; and these

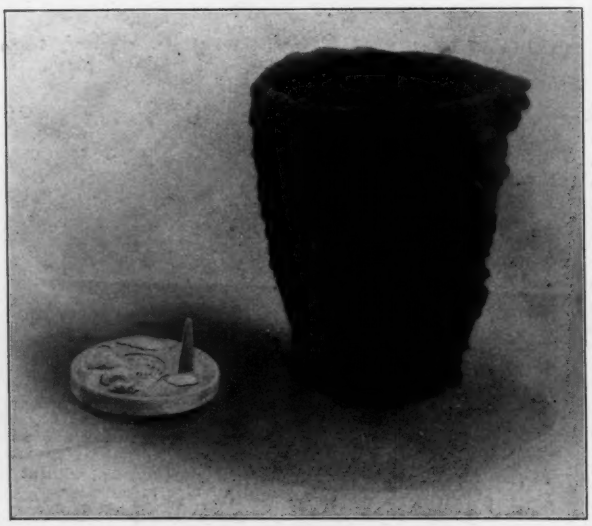


Fig. 5.—Plumbago Crucible after Heating in Furnace Shown in Fig. 4.

are shown alongside the crucible. It will be seen that three of these have fused, including the one listed to fuse at 1770° C.; the only one not fused being listed to fuse at 1810° C. It is thus evident that the temperature attained was in the neighbourhood of 1800° C. The appearance of the crucible is sufficient evidence that, if ordinary fire-clay were used in the construction of these furnaces, the furnace would collapse at the first severe heating. M. Méker has therefore had to develop certain special and very refractory clays for use in his furnaces.

Fig. 6 illustrates a Méker tube furnace in which the flame enters horizontally at the side and curls round the tube spiral

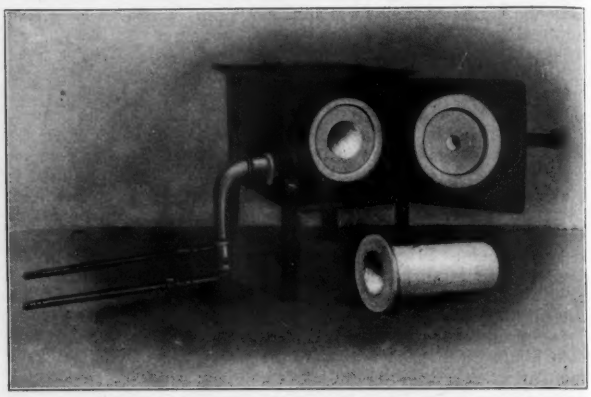


Fig. 6.—Compressed Air Tube Furnace.

fashion. The heating is thus very uniform throughout the length of the tube, and temperatures up to 1650° C. may be obtained. Judging from the ready sale which electric tube furnaces have had, this type promises to be exceedingly popular, since its temperature limit is 300° C. higher than that for electrically heated tube furnaces.

These burners and furnaces have up to the present been very little known in England; but under the new Patent Act they will in future be manufactured here by the Cambridge Scientific Instrument Company, Limited, of Cambridge, who have acquired the sole rights for Great Britain and the Colonies. At the Physical Society's Exhibition in December last, and the Birmingham Scientific Society's conversazione in January, when the Company exhibited them, great interest was manifested; and it is evident that the ease with which high temperatures can be attained, and the economy in gas secured, open a wide field of usefulness to these burners.

LECTURES ON GAS MAKING AND LIGHTING.

In the course of the present and next month, students of gas manufacture and artificial illumination residing in or near London and Edinburgh will have opportunities of increasing their knowledge of these subjects.

Taking the Metropolis first, next Monday evening Mr. Leon Gaster, the Editor of the "Illuminating Engineer," will commence at the Society of Arts a course of four Cantor Lectures on "Modern Methods of Artificial Illumination;" and will continue them on the succeeding Monday evenings. His first lecture will open with a historical summary of incandescent electric lamps; and he will then consider the effect of electric lighting upon the lighting industry, and the lines of its future development. The various kinds of arc lamps will be described. In the second lecture, Mr. Gaster will confine himself entirely to gas lighting; beginning with a summary of its early development, and then passing in review the various burners and methods in connection with it, including the high-pressure system. Modern gas problems and recent developments of street lighting in London and Berlin will be considered; and the lecture will close with some observations on candle-power standards *versus* the calorific power of gas, the lines of further researches, and the Livesey Professorship at Leeds. The third lecture will be devoted to lighting by candles, oil, acetylene, petrol, air gas, alcohol, and other illuminants, including the Kitson high-pressure system; and in the last the lecturer will discuss general problems presenting themselves in illumination and its measurement, deal with the work of the Illuminating Engineering Society, and emphasize the need of the illuminating engineer expert.

Going North, the Keith Lectures at the Royal Scottish Society of Arts for the present year are being delivered by Mr. Henry O'Connor, F.R.S.E., the Lecturer on "Gas Manufacture" in the Heriot-Watt College, Edinburgh, and in the Glasgow and West of Scotland Technical College, Glasgow, whose subject is "Gas Manufacture and Lighting." The lectures are being delivered in the hall of the Society in George Street, Edinburgh; the first, dealing with the history of gas lighting, being fixed for last night. The others will follow on the succeeding Monday evenings up to the 8th of March. Next Monday, Mr. O'Connor will discourse upon the engineering features of a modern gas-works; on the 22nd, he will explain how gas is made; and the last two lectures will be devoted to distribution, including the various methods of utilizing gas for lighting, heating, cooking, and motive power.

LIVESEY WASHERS AS TAR-FOG EXTRACTORS.

COMPARISON OF THE EFFICIENCY OF THE LIVESEY WASHERS AT BRADFORD ROAD GAS-WORKS, MANCHESTER, BEFORE AND AFTER CLEANING OUT AND RENEWAL OF THE INTERIOR.

By R. H. CLAYTON, B.Sc., and F. W. SKIRROW, Ph.D.

IN a paper read before the Manchester District Institution of Gas Engineers in June, 1907, we gave figures showing the efficiency of Livesey washers as tar-fog extractors. The results obtained in the two installations tested showed an efficiency of only about 87 per cent. in both cases; and this was therefore taken as the percentage extraction which might be expected in this type of apparatus. Results recently obtained, however, indicate that this presumption is not correct, but rather that the washer, when in good condition, allows only a small and fairly constant quantity of tar-fog to pass, irrespective of the original quantity in the gas treated.

In the results given in the paper alluded to, the tar-fog in the untreated gases at the two works was roughly 12 grammes and 4 grammes per 100 cubic feet, and in the treated gases 1·5 grammes and 0·5 gramme per 100 cubic feet; the ratios, and therefore the efficiency, being the same in the two cases.

Since these figures were obtained, the Livesey washers at the works with the 12 grammes in the crude gas have been completely overhauled and fitted with fresh interiors by Messrs. C. & W. Walker, of Donnington; especial care being taken to prevent any possible bye-passing of the crude gas through the many cement joints in this type of plant. The testing of the washers was done in both the summer and winter months, so as to get the results under both conditions of gas manufacture.

The estimations were carried out in the manner described in the previous paper [see "JOURNAL" for June 4, 1907, p. 660], and, like those, do not include oils distilling below 100° C. nor free carbon and bodies insoluble in benzene. The following were the results obtained.

Before Cleaning and Renewal.

Date.	Make Per Hour. Cubic Feet.	Difference. Pressure.	Temperature. Outlet.	Grammes Tar-Fog (100 Cubic Feet.) Inlet.	Grammes Tar-Fog (100 Cubic Feet.) Outlet.	Percentage Purification.
December, 1906 . .	..	..	74 Fahr.	11·26	1·54	86·3
,, ,, . .	..	..	73 ,,	10·92	1·44	86·8
February, 1907 . .	..	..	..	10·5	1·39	86·8

After Cleaning and Renewal.

June, 1908 . . .	139,000	1·8	71 Fahr.	17·3	0·79	95·4
,, ,, . . .	137,000	1·8	73 ,,	13·5	0·63	95·3
August, 1908 . . .	138,000	2·5	73 ,,	16·17	0·63	96·1
,, ,, . . .	125,000	2·5	69 ,,	13·1	0·56	95·7
,, ,, . . .	131,000	2·5	72 ,,	15·42	0·49	96·8
January, 1909 . .	389,000	..	63 ,,	7·25	0·45	93·1
,, ,, . .	389,000	..	64 ,,	6·66	0·58	
,, ,, . .	390,000	..	66 ,,	7·06	0·41	

In the tests in June and August, 1908, only half the number of washers were in use.

TEMPERATURE DISTRIBUTION IN GAS-ENGINES.

AT the Meeting of the Institution of Civil Engineers last Tuesday, Professor BERTRAM HOPKINSON read a paper on "Heat Flow and Temperature Distribution in the Gas-Engine," of which the following is an abstract.

In the course of the expansion and exhaust strokes of the gas-engine, from a quarter to a half of the whole heat developed in the explosion is discharged into the cylinder walls. This flow of heat, though its effect on efficiency is relatively small, is very important in the practical working of the motor, because it necessitates the provision of special appliances for its removal from the outside of the engine as fast as it is generated within; and it also requires the existence of a temperature gradient sufficient to carry it from the place where it is generated to that at which it is removed. Consequently, high temperatures must exist in the uncooled parts of the engine, and great temperature differences between one part and another. These conditions give rise to dangers from pre-ignition, and also to mechanical stresses in the metal, which, between them, account for not a small part of the practical difficulties encountered in running large gas-engines.

Given the rate of heat flow into every portion of the cylinder per square foot, it would be possible, by a sufficiently elaborate mathematical analysis, to calculate the distribution of temperature throughout the metal. Apart from the difficulty of the problem, however, the data for its solution are only imperfectly known, and a rough calculation of the general mean temperature distribution is all that is possible. Such a calculation was made in the paper; and it led to the conclusion that the temperature on the inner surface of portions of the engine which are efficiently water-cooled can never rise above quite a moderate value. But the temperature at the centre of an uncooled piston, 12 inches in diameter, may reach 400° C. or even more.

In his paper, the author described experiments made upon a Crossley gas-engine of 40 B.H.P. with the object of determining the actual temperature distribution and its relation to the conditions of working. In the first group of tests, the temperatures were compared with the total loss of heat as measured by the rise of temperature of the jacket water. According to theory, the excess of the temperature at any point over the mean temperature of this water should be proportional to the total heat loss, except in so far as the distribution of this loss over the metal surface exposed to the hot gas is altered. By changing the strength of mixture, keeping other conditions the same, the heat loss was varied between limits of about 1300 and 2200 B.Th.U. per minute —the engine firing practically every time; and it was found that the piston temperature was very closely proportional to the loss of heat. Under normal working conditions at full load, the temperature at the centre of the piston was found to be about 370° C. above that of the jacket water; in the exhaust-valve, 400° C.; and in the inlet-valve, 250° C.

The next group of experiments related to the effect of varying the conditions of running upon the temperature of the metal. The dependence of heat flow and temperature upon the strength of the mixture, the time of ignition, and the degree of compression were also investigated. It was found that if the gas charge be augmented by 30 per cent., the total loss of heat will be increased by 50 per cent., with a corresponding increase in the temperatures of the piston and inlet-valve. Retarding the ignition by 20°, the gas charge and other circumstances remaining the same, reduces the total heat loss by 10 per cent; and the thermal efficiency is reduced from 34½ to 28½ per cent. Advancing the ignition by 10 per cent. has little effect upon efficiency. Comparative trials were made in which the engine was run first in the ordinary way and afterwards with the half-compression cam used for starting purposes kept in action. The result in the latter case was that about two-fifths of the charge of gas and air was expelled unburnt to the exhaust.

Finally, a large number of experiments were made on the phenomena of pre-ignition. In order to cause the engine to pre-ignite, an iron bolt carrying a thermocouple at its end was introduced into the combustion chamber. The end of this bolt was heated by the explosions, and it was found that it could be heated in this way up to a temperature of about 700° C. without affecting in any way the working of the engine, but that if the temperature exceeded 730° C., ignitions would take place from the end of the bolt. The effect of these ignitions is to heat up the end of the bolt more rapidly than before. They thus tend to propagate themselves, and to become more frequent; and if once they start, the engine is bound to pull up. It was found that the line of division between the conditions under which safe and continuous running was possible and those under which the engine was bound to pull up was very narrow, and could be represented by an increase in the gas charge of only 1 per cent. This instability is due to the fact that the gas near the point of ignition of an explosive mixture is heated to a temperature much above the mean by the rise of pressure which follows its ignition. Thus the fact that ignition takes place through the bolt tends of itself to make the bolt hotter, and so to cause earlier and more frequent ignitions from the bolt.

Coal in Kent.—Information has been received at Dover that another seam of coal, 1 ft. 9 in. thick, with fire-clay, had been struck in the area of the Kent Coal Concessions Group between Dover and Canterbury; the new seam at 1364 feet being only 16 feet below the 2 ft. 3 in. seam lately struck in boring, as mentioned in the "JOURNAL" last week.

The Eighty-Cent Gas Law in America.—The Supreme Court of the United States has refused the petition of the Consolidated Gas Company of New York for a re-hearing of the case involving the validity of the 80-cent gas law. It may therefore be expected that the sum of about $9,000,000 (£1,800,000) due to the gas consumers, representing the excess charge made by the Company while the case was pending, will be refunded to them. The announcement of the decision of the Court caused a break of four points in the Company's stock.

Mrs. B. H. Thwaite Fund.—In the "JOURNAL" for the 29th of December, the attention of our readers was directed to an appeal that was being circulated, by an influential Committee specially formed for the purpose, for funds on behalf of the widow and two children of the late Mr. B. H. Thwaite, whose work in connection with the utilization of the waste gas from blast-furnaces for the production of motive power has been universally recognized. It may be remembered that the circumstances of the case were laid before Mr. Carnegie, who promised to give £500 conditionally upon a like sum being subscribed by others. We regret to learn that the appeal has not received the support from the British iron trade which the Committee felt it deserved, in view of the value of Mr. Thwaite's labours, and that a sum of about £200 is required before they can claim from Mr. Carnegie the amount he generously promised. We are asked to assist in giving publicity to this fact, in the hope that the further appeal may bring in the balance. The Hon. Secretary to the fund is Mr. W. H. Booth, of No. 2, Queen Anne's Gate, S.W., who will be pleased to acknowledge any contributions which may be sent to him.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

A Meeting of the above Association was held on Saturday at the Manchester Technical School. In the unavoidable absence of the President (Mr. E. J. Wellens), the chair was taken by Mr. J. TAYLOR, the Vice-President.

The CHAIRMAN briefly introduced Mr. H. H. MERCER, of Widnes, who read the following paper:

PRELIMINARIES TO INCREASING STORAGE CAPACITY.*

In presenting this paper, the object is to describe the conditions which lead to the necessity for additional storage capacity in a gas-works, and, when this has been determined, to review points which confront, and have to be borne in mind by, those who may be called upon to undertake such work.

I presume that the invitation of our Committee to myself, to read a paper of this description, is the outcome of the visit of the members of the Association to the Widnes Corporation Gas-Works some time ago, when those who attended saw the tank for the new four-lift spiral-guided holder in course of construction. At the outset, it must be understood that I have no personal qualification for reading a paper on such an important question; and my subsequent remarks must therefore very largely be confined to the way in which the subject was discussed and dealt with by my Chief, Mr. Isaac Carr (to whom I express my gratitude for granting me free and ready access to all reports and papers relating thereto), when the holder referred to was under contemplation. And this, I suppose, is what you really require.

It will, of course, be borne in mind that conditions which apply in one case are not always applicable in another; and in dealing with questions such as the one we have now in our minds, local conditions require to be carefully observed and studied. In the course of the paper, it will be my endeavour to deal with the points as they arise, in the following order: (1) Conditions showing the necessity for increased storage capacity. (2) Holder capacity in relation to maximum consumption. (3) What should the total storage be? (4) Choice of site. (5) Nature of subsoil. (6) Type of tank. (7) Type of holder. (8) Effect of capital outlay.

The conditions which lead to the necessity for increasing storage capacity are patent to all; but they occasionally manifest themselves before being realized. Therefore the display of a considerable amount of foresight is required to keep a going concern abreast of the demands made upon it in this direction. We now and again hear of—and some present may have experienced—very anxious and worrying times, when, during the days of maximum consumption, much loss and inconvenience has been caused through inadequate storage room. Under such conditions, and at such times, various schemes have to be resorted to to overcome the trouble and maintain a supply. Pressures have to be reduced, which not only have the effect of checking the output, but cause much annoyance and inconvenience to consumers through insufficient supply, especially affecting, of course, the lower districts.

Another method sometimes resorted to to cope with the demand at times such as these, is that of frequent charging of the retorts, with the consequent loss through drawing fuel from which the full yield has not been obtained. Further, if a manager be fortunate enough to have spare beds at his command to light up and let down according to the fluctuations in the demand, the frequent starting and stopping of beds has, as you are aware, a disastrons effect upon the life of the retorts. These, I submit, are conditions which should, where possible, be anticipated and avoided, as not only must they be a source of constant dread and worry to the management, through the feeling of insecurity which must obtain, but the probability is that a considerable amount of business is lost through the disinclination of consumers to extend the use of gas for the many purposes to which it can now be adapted through the fear of being unable to obtain a regular and adequate supply for their requirements.

The first point which naturally presents itself in the consideration of this subject is: "What is the holder capacity in relation to the maximum consumption?" And when this information has been obtained, it is necessary to determine what this should be. In arriving at the decision, it is necessary to bear in mind not only present requirements, but to strive to look well into the future, so that when development takes place and business increases, provision is made to cope with, and supply, the demand, without the difficulties and drawbacks I have just related. At the time this subject was under consideration at Widnes, a tabulated statement was prepared showing the maximum makes and consumptions per diem for a good number of preceding years, which revealed the fact that the maximum make had risen from 306,000 to 1,153,000 cubic feet per diem; while the maximum consumption had risen from 344,000 to 1,191,000 cubic feet per diem. This statement of actual results was further extended for a number of years, with the estimated probable makes and consumptions; the estimated figures being based on the actual rates of increase in the preceding years.

With this information prepared for guidance, it is necessary to decide what the total storage room should be to ensure a regular and constant supply at all times. This figure, I think it is pretty generally acknowledged, should be equal, or at least nearly equal, to the maximum consumption per diem. As I have just stated, the maximum gas consumption at Widnes, at that time, was 1,191,000 cubic feet, while the total storage capacity was 1,200,000 cubic feet—being made up as follows: Two holders at our Ditton station (which is about 1¼ miles from the works)—one, an ordinary two-lift holder of 400,000 cubic feet capacity, and the other a three-lift Gadd and Mason columnless holder, of a capacity of 700,000 cubic feet, making the total storage room at this station 1,100,000 cubic feet; while the only other source of storage consisted of an old worn-out holder of 100,000 cubic feet capacity on the works site, which it was necessary to remove, as the site was required for other purposes. [It will perhaps be as well to explain here that this holder has since been removed, and the tank converted into a storage-tank for tar and liquor; while the top has been covered in with reinforced concrete, thus securing valuable yard space for coke storage, &c., which was urgently required.]

From the figures quoted, it will be seen that practically at this time the storage capacity was 8 per cent. less than the maximum consumption; while it was 32 per cent. less than the estimated requirements at the end of the following two years, by which time it was expected the contemplated work would be completed and the holder be available for use. With this information for guidance, it was decided to erect a one million cubic feet holder. It may occur to some of you that, with the existing storage room as described, an additional holder of such a size—*i.e.*, practically double the maximum output at the time—was looking too well ahead, and inflicting an unnecessary burden on the interest and sinking fund account. This, however, was not the case, as I will explain later; and, further, the ample room obtained on the completion of the work, has created a sense of security, which had not, at any rate for some years previously, existed. It will no doubt interest you if I quote here what the actual maximum consumptions have turned out to be since the time in question. They are as follows:—

1906–7	1,430,000 cubic feet.
1907–8	1,531,000 ,, ,,
This year 1908–9	1,640,000 ,, ,,

A point of the utmost importance which requires close consideration when it has been decided to erect a holder is the choice of site; and in a town where the works have been established half-a-century, with the surroundings pretty thickly covered with works and buildings, this was no easy task. A site could have been obtained adjoining the other holders at our Ditton station; but for reasons I will relate, this was not desirable. As previously explained, the only storage on the works was a small 100,000 cubic feet holder, which it was necessary to remove; and it was considered by my Chief most important and desirable for the new erection to be in close proximity to the manufacturing plant, because of the danger of the failure of the driving main to Ditton (which might occur from some external cause), which would shut off the gas in stock from the town, with the consequent prospect of putting the district of supply in darkness. Further, the erection of another holder at Ditton, of the size required, would have entailed either the enlargement of the existing driving main, or the laying of an additional one, as the one in use would be insufficient to deal with the extra work required of it, and, again, this work, if done there, would have meant the extra expenditure of a large sum of money on mains—a point you well know would not be lost sight of by Mr. Carr.

These reasons led to the search for a suitable site in the neighbourhood of the works; and after much negotiation, the site was secured which some of you have seen. The site, containing about 9660 yards, is much larger than the area required for the new holder; and the north-east portion was, and is at present, occupied by the works and buildings of the vendors (who retain it for a few years). However, sufficient unoccupied land was available for the erection

* For illustrations of the holder here referred to, see the number of the "JOURNAL" for Feb. 5, 1907, p. 341.

	(1)			(2)			(3)		
	400,000 Cubic Feet.			700,000 Cubic Feet.			1,000,000 Cubic Feet.		
	Total Cost.	Cost per 1000 Cubic Feet.	Cost per Cubic Foot.	Total Cost.	Cost per 1000 Cubic Feet.	Cost per Cubic Foot.	Total Cost.	Cost per 1000 Cubic Feet.	Cost per Cubic Foot.
	£ s. d.	£ s. d.	d.	£ s. d.	£ s. d.	d.	£ s. d.	£ s. d.	d.
Tank	3908 14 2	9 15 5	2·34	2800 0 0	4 0 0	0·96	2615 0 0	2 11 3	0·62
Holder	3534 6 0	8 16 9	2·12	4900 0 0	7 0 0	1·68	5629 0 0	5 10 7	1·33
Total	7443 0 2	18 12 2	4·46	7700 0 0	11 0 0	2·64	8244 0 0	8 1 10	1·95

required. A very important point in considering this purchase was, as you will observe, the fact that the site lends itself admirably to the extension and improvement of the existing works, and a scheme has been prepared so that when the whole of the land comes into the possession of the Corporation, it will enable them, if necessary, to increase the capacity of the manufacturing plant, which is now 2 million cubic feet, to 3½ millions. It will further enable improved railway facilities to be obtained.

Another point upon which full information and a close knowledge is required in the preliminary stages in dealing with this question, is the nature of the ground upon which the work is to be carried out, so that plans and specifications can be carefully prepared and all contingencies guarded against, as any failure in this respect must, of course, prove expensive and disastrous. To this end, on the site in question, four trial bore-holes were sunk, each 30 ft. 6 in. in depth, which proved the understrata to consist of strong natural red clay, most suitable in every respect for the construction of the cheapest and most durable type of tank—*i.e.*, bricks set in cement mortar with puddle backing. Those present who visited the Bradford Road works of the Manchester Corporation on Jan. 9 saw a similar tank, on a much larger scale, in course of construction.

The site is bounded on four sides by road, foundry, railway, and a culvert; and so the diameter of the tank had to be curtailed. To obtain the one million cubic feet storage room required, it was decided to increase the height of the holder—the most economical way out of the difficulty, as my Chief put it, as there was no charge for going higher. During the progress of the work, it was very necessary to see that the excavation was properly and securely shored, to prevent the earth from falling in—especially so on the sides next to the foundry and the Bowers Brook culvert, to resist the additional stress arising from each.

With regard to the holder itself, as this erection possesses the distinction of being the first four-lift holder built on the spiral-guided principle, a description of some of the most prominent features which finally led to its adoption, will no doubt be of interest to you all. In the first place, the adoption of this type of holder enabled the utmost use to be made of the available space, as, had the ordinary type been adopted, the diameter of the tank would have probably been under 105 feet, on account of the extra space required for the tank piers, whereas a tank of 118 feet diameter was obtained. Secondly, the cost of this type of holder represented a substantial saving over any of the holders offered with external guide framing; while there was also in its favour the additional fact that there would be a substantial annual saving in the cost of maintenance (estimated at £50), which sum it would have been necessary to expend in keeping the guide-framing in good order, had this type of holder been adopted. This item of maintenance is particularly important in a manufacturing district such as ours, where the atmospheric effect upon ironwork—unless carefully preserved—is most disastrous, and the truism that "you should never put ironwork where paint brush cannot get" has to be carefully observed. For this reason, the type of holder adopted was most suitable, as it lends itself much more readily than the guide-framing type to the hands of the workman for the purpose of scraping and painting.

Further, the new design, as presented by Messrs. R. & J. Dempster, offered several important improvements over that of the Ditton holder on the same principle which was erected in 1893. On the Ditton holder there are 16 spiral guide rails on each lift; while on the new holder there are 12 on the top and second lifts, 18 on the third, and 24 on the fourth, or bottom, lift—thus increasing the power of the grip as the holder extends itself in height. Another new feature introduced, is the patent spiral plate, 12 inches wide, which extends the full lift of the holder. To explain the advantage of this improvement, it is necessary to state that an essential point in the success of a spiral-guided holder is that the rotary motion—amounting to one-third the circumference—should be accomplished with absolute freedom of action, so that there is no possibility of an increased pressure being thrown by the holder at any point of its rise or fall, owing to the friction between the rails and the rollers. Experience has taught that, in order to accomplish this successfully, it is necessary for the rails to be laid on a perfectly level surface; and this was a difficult matter to overcome on account of the joints and rivets in the sheeting of the holder. This patent spiral-plate, however, to which the rails are attached, has surmounted the difficulty, as by this means all joints in the sheeting are avoided, and the rails lie perfectly flat on the spiral plate, which is butt-jointed, with cover-plates on the inside. This improvement also adds materially to the strength and durability of the holder, as it has been found, where the spiral rails are attached to either the sheeting or to stronger plates, that the steel rail cannot be satisfactorily bedded to the shell, and, consequently, when water flows down the outside of the holder from the crown, it percolates between the steel rails where they pass over the joints in the sheeting, and continual rusting takes place, which it is impossible to prevent, except by removing the rails to clean and paint the sheets behind them.

Another contingency of the revolving motion of this type of holder is in the event of a strong formation of ice inside the tank, when there is a risk of it overturning the inlet pipe unless proper precautions be taken against it. In the tank at Widnes, a column of concrete is carried up round the pipe, of sufficient strength to resist any lateral stress that may come upon it from ice thrust—thus rendering the pipe perfectly secure.

Another patented improvement adopted in this holder is the extension of each lift so as to form a basin round the crown, or dips; openings being made at each rail to allow any accumulation of water to run down the rails into the cups or tank of the holder. This obviates also the unsightly appearance which many holders have when fully extended, through rain running down the sides from the crown; while it also serves to preserve the lifts of the holder, as it has been found that the action of the drippings from the crown has rendered another coat of paint necessary long before the protected parts require it.

As to the stability of this class of holder, my Chief had no doubts in this direction, as the holder at Ditton has proved itself in every respect satisfactory since gas was first turned into it, in December, 1893. The holder stands in an exposed position, and has on many occasions been fully extended during the most violent gales, when only the slight motion due to the elasticity of the structure, was perceptible.

With regard to the effect of capital expenditure upon the interest and sinking fund account, this is a point which, from a perusal of the capital accounts which some unfortunate undertakings possess, does not always appear to be borne in mind when money is being laid out on gas-works. This point, however, was not lost sight of in the case in question, as you will observe from the following figures, which show the annual sale of gas, with the charge for interest and sinking fund per 1000 cubic feet sold, before and after the purchase of the new holder, from which you will see that the expenditure has had no appreciable effect on the account per 1000 cubic feet of gas sold—in fact, it is less than it was, owing to the increased sale of gas.

Year.	Gas Sold. Cubic Feet.	Interest and Sinking Fund, per 1000 Cubic Feet Sold. Pence.
1904-5	275,874,500	2·70
1905-6	283,785,700	2·61
1906-7	306,566,600	2·43
1907-8	342,151,900	2·48

The following particulars and figures of comparative costs of the last three holders erected at Widnes are interesting, and go to show that due regard to judicious capital expenditure has been observed when the erection, together with the effect of the outlay, has been under consideration:—

1.—Two-lift ordinary type at Ditton Yard. 400,000 cubic feet.	Top lift	101 ft. 8 in. by 25 ft.
	Bottom lift	104 ft. 0 in. by 25 ft.
	Tank	106 ft. 0 in. by 25 ft.
2.—Three-lift, Gadd and Mason at Ditton Yard. 700,000 cubic feet.	Top lift	110 ft. 9 in. by 24 ft. 6 in.
	Middle lift	113 ft. 3 in. by 24 ft. 3 in.
	Bottom lift	115 ft. 9 in. by 24 ft. 0 in.
	Tank	118 ft. 0 in. by 24 ft. 0 in.
3.—New four-lift at gas-works, Widnes. 1,000,000 cubic feet.	Top lift	108 ft. 6 in. by 26 ft. 0 in.
	Second lift	111 ft. 0 in. by 24 ft. 6 in.
	Third lift	113 ft. 6 in. by 24 ft. 6 in.
	Bottom lift	116 ft. 0 in. by 24 ft. 6 in.
	Tank	118 ft. 0 in. by 26 ft. 0 in.

In conclusion, I think the following statement will be of interest to you, showing as it does the development in storage capacity, with the growth of the Widnes works since their establishment in 1860, when the consumption of gas was only 13 million cubic feet, while to-day it has risen to 342 millions.

Size of Tank. Feet.	Capacity of Holder. Cubic Feet.
33 by 12	9,000
40 ,, 16	20,000
50 ,, 20	40,000
82 ,, 20	100,000
106 ,, 25—Ditton.	400,000
118 ,, 24—Ditton.	700,000
118 ,, 26—New holder	1,000,000

The first four holders all stood on the existing gas-works site, but, having served their day, have been removed to enable improvements and extensions to be made on the works; the fourth being the one previously referred to as having been recently converted into a tar and liquor storage tank.

Discussion.

Mr. C. E. Teesdale (Salford) said, with reference to the remarks of the author on holding capacity and maximum make, the recognized 24-hours standard should not apply to such places as Salford and Manchester, where they had at times to put up with probably a week of fog. At these times their resources were strained to the utmost extent, and they had either to reduce the pressure or resort, as Mr. Mercer said, to the more frequent charging of retorts, with the consequent loss through drawing fuel from which the full yield of gas had not been obtained. It seemed to him that in the construction of the additional holder Widnes had been particularly fortunate in coming across such a subsoil of clay as they had found. In most cases, people putting up a new holder were not so lucky, and consequently the construction cost more than had been the case at Widnes. As to Mr. Mercer's estimate of £50 for repairs to the guide-framing of the holder, he considered the sum excessive; and it seemed to him that if this figure was correct, there must be something wrong with the framing. The only expense he could see would be the painting of the two holders. Mr. Teesdale concluded by saying that he personally was much indebted to Mr. Mercer for the information given in the paper, because it had brought out matters of importance, and had dealt clearly with difficulties which had to be faced.

Mr. J. Alsop (Stockport) said he had been much interested in the careful and methodical way in which Widnes had approached the subject of increased storage. Cases had been known where such consideration had not been shown. This had happened both ways—viz., too little had been allowed, or much larger plant than was necessary had been put down; thus increasing the capital account for the annual charge for interest and sinking fund. The thanks of all the members were due to the "Journal of Gas Lighting" for the use of the illustrations accompanying the paper, as by their aid the members had the advantage of having the holder in front of them, as it were. He noticed from the illustrations that the grip of the holder to the tank was provided for by an increased number of spiral girders —24 at the bottom, 18 on the third, and 12 on the top. He wondered if it would have been of any advantage to have had larger plates so as to save joints. He had an idea that on one of their visits the members of the Association had an example shown; he believed it was at Longwood, but was not certain. Another feature which struck one was the power this type of holder had to resist oscillation. This, as they were all aware, was a decided advantage when snowstorms and other contingencies arose, whereby a holder was likely to become tilted. Looking on the economical side of the question, he noticed that at a meeting of the Eastern Counties Gas Managers' Association in April, 1905, Mr. W. D. Child, of Romford, gave a few comparative costs of holders, ranging from £28 per 1000 cubic feet to £16 5s.; the latter holder, having a masonry tank 160 feet diameter and 35 feet deep, being a three-lift, with a capacity of 1,850,000 cubic feet. Mr. Child remarked that a spiral-guided holder having the same capacity might be erected with four lifts instead of three, and the tank reduced in depth to 26 feet; the result being a saving in tank cost of £4600, and dispensing with 300 tons of metal. This, he thought, had been proved to the members by what was done by Mr. Carr in 1907—two years later. Mr. Mercer had in his paper referred to the special protection of the stand-pipes on account of the ice, &c. In this connection he might mention that in April, 1907, at a meeting of the North of England Gas Managers' Association, Mr. Gadd brought under the notice of those present a spiral-guided holder which had a vertical travel. This was very probably to overcome any damage to the stand-pipe. What was Mr. Mercer's opinion in regard to this type—spiral, but with vertical travel?

Mr. A. L. Holton remarked that it would be of interest to the members if Mr. Mercer explained how a saving of £200 was effected on the tank.

Mr. J. H. Davis (Oswaldtwistle) said he was not sure that it was advisable to have only the one pipe for the inlet and outlet to the holder. Of course, it was not for him to criticize Mr. Carr, but he thought in small works, where they had only one holder, they should have the inlet on one side and the outlet on the other. As to the rest-blocks, which at Widnes were of concrete, he was not at all sure whether this material was as good as stone for the purpose.

Mr. Handley (Rochdale) thought it was a defect in the holder that it had only one pipe for the inlet and outlet of the gas, because it was a well-known fact that works did not always make the same quality of gas—say, during the night as compared with the day, when the stokers were more closely watched.

The Chairman, referring to the point raised by Mr. Davis and Mr. Handley, said most engineers did not like to have two openings in the tank, because it tended to weaken the wall. He had been struck by the difference in the cost of the tanks, and would be glad if Mr. Mercer could explain how it came about; and also tell them if water had been noticed lodging in the joints of the spiral sheets.

Mr. Mercer, in reply, said the estimated cost of the painting of the holders was not, in his opinion, excessive; but it might be that the conditions obtaining at Widnes were not the same as those at other places. At Widnes they had to keep men scraping, cleaning, and painting the structure all the year round; and he was satisfied that his estimate was much about right. Having said, in answer to Mr. Alsop's query, that engineers did not, as a rule, seem inclined to adopt such a method, he proceeded to deal with the point raised about having only one pipe for the inlet and outlet. He was prepared to admit that in small works, where they had only one holder, a single pipe would present a difficulty, and that it would be better to have the two pipes. At Widnes, where they had several holders, they had no difficulty on this head. With regard to the cost of the tank, it was probable that they were fortunate in letting the contract at the time they did. The tanks were of the same type, and the fact that one was at Ditton and the other at Widnes might account for the contractors sending in a more favourable tender for the latter. In answer to Mr. Taylor's question, he had not noticed water lodging at the joints of the spiral sheets; there being sufficient fall to bring the water down to the cups.

On the motion of Mr. M'Nichol (Warrington), seconded by Mr. Dean (Altrincham), a cordial vote of thanks was passed to Mr. Mercer for his paper.

The compliment was briefly acknoledged.

Mrs. Amélie Andrews, the widow of Mr. Thornton Andrews, of Swansea, who, it may be remembered, survived her husband only a week, left estate of the gross value of £3172, with net personalty of £2912.

VICTORIAN GAS ASSOCIATION.

Questions Discussed at the Third Annual Meeting.

In the last number of the "Journal," we reported a portion of the proceedings at the third annual meeting of the above-named Association, which was held early last November at Ballarat, under the presidency of Mr. S. E. Figgis, the Manager of the Ballarat Gas Company. A considerable part of the time of the meeting was occupied in discussing the subjects in the "Question Box," of which there were five. They gave rise to the following remarks.

I.

"What method of charging gives the best results—light charges at short intervals, or heavier charges at longer intervals?"

Mr. W. Pain (Bendigo) said he thought it depended altogether on circumstances. If direct firing was practised, he favoured six-hour charges. If regenerative furnaces were used, he also favoured them and six-hour firing. But when the consumption eased off, he found it economical to work with eight-hour charges and firing—following the principle of charging according to the consumption, instead of letting-down a bed for three or four months and relighting it again. He thereby got the maximum of gas out of the coals, as well as a first-class coke, and used a minimum of coke in firing, with the least possible labour. As circumstanced at present, he was charging every eight hours with 3 cwt. charges.

Mr. R. O. Thompson (Melbourne) asked whether he was doing this purely to avoid letting-down.

Mr. Pain said he certainly was. Under the regenerative system, expansion and contraction sometimes caused a great deal of damage; at least, he found it so. It was a great advantage to keep going with eight-hour charges. He eased the dampers according to the firing. He used D retorts, 21 in. by 15 in. and 10 feet long. Of course, he also had ovals, 20 in. by 16 in.; but he worked with the D's principally, eight in a bed. In winter time he fell back on six-hour charges and six-hour firing, and got quite as good a result, burning-off 3 cwt. charges. He gained in labour, roughly speaking, three hours in each shift, and found he could put the men to other work. They wheeled the coal from the sheds.

Mr. Thompson remarked that, supposing their circumstances were the same as Mr. Pain's, what would he advise them to use—long or short charges, without any other consideration such as wear and tear or labour saving?

Mr. Pain said he would prefer the six-hour charges on account of getting better gas; and he could manage on these charges with a less number of retorts. This would to a greater extent conduce to convenience, and save cost. He was never troubled with naphthalene. The shorter charges could be more carefully watched as he was circumstanced. He had a steam-jet exhauster and self-sealing mouthpieces. Without careful watching, a certain amount of air would get in that could not enter through a luted mouthpiece.

Mr. J. Bowman (Sale) asked whether he understood that Mr. Pain got better quality gas by six-hour than by eight-hour charging.

Mr. Pain said of course he did, and also a better coke.

Mr. Holmes Hunt (Melbourne) asked Mr. Pain if he increased the charge for eight hours work.

Mr. Pain said he did, if necessary; but it was according to the consumption.

The President said if Mr. Pain did not increase the charge, could he give them an idea of what extra gas he might get by more carbonization?

Mr. Pain said he had never tested that. His average was about 11,000 cubic feet per ton for the last five years; his gas being from 16 to 16½ candles. He was using Abermain coal, and his average make per ton was 10,500 cubic feet. He put down to one ton of this coal (six charges for eight hours) 13 cwt. of coke and 1 cwt. of breeze. He had not tested the quantity of tar; but he put it down at from 10 to 11 gallons per ton. His residuals for the last six years had averaged 13s. 2¼d. per ton of coal carbonized.

The President remarked that they must keep to the subject of the discussion. What they wanted to get at was whether there was any advantage to be gained by long or short carbonization.

Mr. W. Ray (Adelaide) said he had several small works to manage, and could give the members an example where probably a bed of three retorts might do better. They worked five retorts, and when consumption eased, just as Mr. Pain had said, they charged eight hours instead of six, so as to avoid continually putting on an extra bed, shutting it off, and then putting it on again. But he understood Mr. Pain to say that he got 13 cwt. of coke for sale.

Mr. Pain: No. That was the total make per ton.

Mr. Ray (continuing) could not say anything about residuals in shillings and pence, but in three years their coal cost £20,631, and they got for residuals £15,815. This was a matter of 76·65 per cent. of the coal bill. Next year the coal cost £21,278, and residuals came to £19,753—or 92·80 per cent. of the coal bill. The reason of this result was that the previous year they put into

stock a large quantity of coke, and they sold in that period £10,000 worth of it. In the past year their coal cost £27,158, and they received £22,438 for residuals—a matter of 82·78 per cent. The President had put to Mr. Pain a question to which he (Mr. Ray) would like an answer: When putting a 3 cwt. charge into the 21 in. by 15 in. by 10 ft. retort, and working on six-hour charges, apart altogether from convenience, what did he gain? One would rather imagine his make would run up very considerably under eight-hour working. There were a certain number of pounds of gas, coke, tar, and water to the ton; and if he got an increased make, it must, of course, be thinner. He could quite understand Mr. Pain's idea. It was a very great convenience to work retorts in the way he did.

Mr. PAIN said he worked the retorts regularly. He considered the most damage occurred when a bed was shut off for 12 or 24 hours, and not worked at all.

Mr. RAY asked whether Mr. Pain gauged by a jet or a bar photometer.

Mr. PAIN: By the jet photometer.

Mr. C. W. HOWLETT (South Melbourne) said they had to consider the quality of their gas. Undoubtedly if they worked six-hour charges, and put in the same bulk of coal they would do for eight hours, they would get a better quality of gas in the six than in the eight hours. Again, when putting in charges for a long period, it was necessary to regulate the heats. They must not carry too high heats for the same quantity of coal; otherwise they would naturally have to increase the coal if they prolonged their charges. He was of opinion that with eight-hour charges, if they increased them from 3 cwt. to 4 cwt., they would get better results than with six-hour charges on the smaller quantity. He thought they would get a more even quality of gas, and their beds would also be more likely to keep regular heats. They would not be taken down so easily, and it would assist them to regulate their fires. The coke would be better burnt off, and they would get improved results from their sales. With the regular and good heating coke, much better heats would be obtained. When feeding their retorts with the residue of coke, it was a great item to keep the heats regular; it assisted to the best carbonization. He also thought it gave much better results all round, including the quality of the gas; and they could work their charges to much better advantage in the handling of the men.

Mr. W. SWINBURNE (Melbourne) remarked that in many of the small gas-works they were in the habit of putting in very heavy charges; and in some instances they allowed them to stay in for twelve hours, because the men were so situated that it would be inconvenient to charge at any other time than early in the morning and in the evening. At one works in Queensland, they put in 4 cwt. of coal, and let it remain for twelve hours. It was a particular class of coal from which they got from 9000 to 9500 cubic feet of gas per ton, according to the conditions. The result was not bad, as in much larger works in Brisbane they only had 9000 cubic feet, working with the same charges. So it would appear that there was no great detriment—rather the reverse—in letting a charge remain in for a long period. In many of the Victorian works they only charged twice a day (morning and evening), and put in 3 cwt. of coal per charge. For the reason that they could not charge oftener, they were not in a position to say which was the better method. Nevertheless, in these Victorian works, by charging only twice a day, they obtained from 10,000 to 11,000 cubic feet of gas per ton.

Mr. BOWMAN said his works were only quite small ones; but his experience was that if they worked off a small charge with a high heat, towards the latter end of the charge the quality of the gas commenced to run down very rapidly. The first hour it was 25 or 26 candles; but it gradually deteriorated until it got down to about 14 candles. He had tried both small and large charges, and he agreed with Mr. Pain to a very considerable extent, subject to the risk he had mentioned. His experience was that he could get from 1500 to 2000 cubic feet more gas per ton of coal by using smaller charges with high heats than by having heavier ones with less heat.

Mr. RAY observed that the father of carbonization—Mr. John West—was always a believer in light four-hour charges and working them off. His dictum with his machines was: High heats and small charges.

Mr. W. W. MORRIS (Benalla) said light charges at frequent intervals might be all very well, but he had found it much better to work heavier charges for longer periods. He usually put in 3½ cwt. and let it go for ten hours. He obtained in this way a very much better class of coke and slightly more gas.

Mr. THOMPSON said they all knew that in Scotland for a long time they had very short charges—four and three hours. Now they were using more of the commoner coal, such as the English people used, and they found it advantageous to increase the length of the charges. There was for years a great difference in this respect between the Scotch and English practice. In England it used to be six hours. He remembered about five years ago Mr. Tysoe, of the East Greenwich works of the South Metropolitan Gas Company, introduced a setting of small retorts (12 inches diameter) with the view of having short, sharp charges. There were about twelve of these retorts in one bed. After testing, they had to give them up. The idea was that short, sharp charges would give more and better gas; but in practice it did not work.

Mr. PAIN said, of course, the coke meant a great thing to them in Bendigo. They got 30s. a ton for it at the works. He was getting more for sale by one quarter by the method he had described. So far as weighty charges were concerned, he put in at the rate of one ton in six retorts. They were scoop charges in shovels, the charges taking place alternate hours each bed.

Mr. HOLMES HUNT said he thought this question was one that affected small works in a very different way from larger ones. He was quite able to appreciate the difficulties that had to be contended with in small works, and the great convenience it was to vary the charges in the way Mr. Pain had set forth. He thought that, however small the settings were, the longer and the heavier the charge, the better would be the result. With regard to larger installations, there was no doubt whatever in his mind that the heavier charges were the correct thing with proportionately longer time for burning off. General results of carbonizing in the last three years pointed in this direction. He was speaking now of large carbonizing units, following the introduction of the De Brouwer machinery which members had an opportunity of seeing at the Metropolitan Gas Company's works at West Melbourne the previous year. It was quite evident to him that it was more convenient to work the heavier charges—for the operation of the machinery, the arrangement of the work of the men, and the working of the retorts. He thought everything pointed to better gas and an improved make being obtained by the system. He was unable to quote results from West Melbourne, because there were two or three systems working there; but they had been charging at eight-hour intervals with 8 cwt. charges in 20-feet retorts. He should like to emphasize one matter in comparing results, and that was the question of correcting the make to the standard temperature. The results that Mr. Swinburne mentioned just previously as having been realized in different parts of Queensland might have been obtained without taking the temperature of the gas at the station meter and correcting to 60° Fahr. Therefore they would be a great deal helped by expansion. This was a matter which he thought they should take up. They should get thermometers and correct the makes after taking regular readings. By this means, they would get comparative data that could be relied upon; otherwise they would always be in the dark as to comparisons, notwithstanding the makes quoted. He did not think many of those mentioned had been corrected to standard temperatures. He had said that the use of heavier charges was advantageous, and that the charges at West Melbourne were 8 cwt. ones. The conditions would tend to a higher make, and quite as good, if not better, candle power, since there was less heating surface for the gas to come in contact with on its way to the ascension-pipe. The advantage from the machinery point of view was quite evident. The heavier charges were better pushed out by the new type of machinery than the lighter ones. He was quite convinced that in most large works eight-hour were better than six-hour charges. To this end the new plant they had just put in at South Melbourne was deliberately designed; and, so far as they had gone, they were quite satisfied with the results obtained from it. There was still further evidence that large charges were the thing for the future. The vertical retorts pointed to it; and not only verticals, but also the carbonizing chambers which had been introduced into Germany and England. In the latter, large quantities of coal were carbonized at a time. Those who had had the opportunity, as he had, of making a little study of the modern coke-ovens, putting 2, 3, and 4 tons of coal into one chamber as a charge, could not help being impressed by the advantage, from a labour point of view, of this innovation, if it could be successfully applied to gas manufacture. From the gas point of view, the system had yet to be proved; but good reports were forthcoming as to the results obtained from these chambers in Germany. It would appear that the carbonizing of the future was certainly going to be something in the way of heavy charges in horizontal chambers or vertical retorts on the intermittent or continuous system. It might be of interest to the members to know that only the previous day he had information that the Woodall-Duckham continuous carbonizing system was now working very well; the coal automatically going in at the top and the coke coming out at the bottom with an entire absence of steam and smoke, and the retort dealing with over 3 tons of coal per day. This showed an advance, the development of which they must watch intently.

The PRESIDENT said he thought they had had a very interesting discussion; but there was one point which he should like to emphasize. It had been proved almost to demonstration that the fuller they could keep a retort, the less trouble they would have with naphthalene. The chemical interchanges which took place in the retort were very abstruse; and they were by no means solved. This much, however, seemed to have been proved—that if a retort was lightly charged, some of the richest hydrocarbons, such as the methane and ethane, if allowed to have free contact with a portion of the retort that was highly heated, would be cracked-up, with a consequent loss in the illuminating power of the gas. Hence it was found that in the vertical retort, which was absolutely filled with coal, the illuminating power of the gas was inclined to be better; and it worked towards the absence of naphthalene.

Mr. THOMPSON remarked that it simply came to this—that they had no empty space.

The PRESIDENT agreed, and said they also had less carbon deposited in the retort. Mr. Hunt had told them what was going on in England. It was very possible that within the next four or five years they would see a wonderful change in carbonizing

methods. They had some excellent experimenters at work, and the fruits of their labours were being shown at the present time, and would be still more forcibly shown in the near future. He used in the Ballarat Gas-Works a scoop, and they charged it to the extent of 3 cwt. a retort every six hours. The difficulty he had had was in getting more than 3 cwt. of coal in one scoop; but he thought he would solve this, notwithstanding the fact that the scoop was so big that it would only just turn in the retort, and in future try some eight-hour charges with an increased quantity of coal. His retorts were 22 in. by 14 in. The conditions varied so much in small works that it was absolutely necessary to have prolonged carbonization. He thought they would find that it was decidedly beneficial to put as much coal as possible into a retort, so long as they gave it a proportionately lengthy carbonization.

II.

"*As our ammoniacal liquor will not pay us to work up, we run it away into a drain. The local council complain of its being a nuisance. How can I best treat it cheaply and effectively so as to prevent this?*"

Mr. T. Lord said this was a question which in reality required a chemist to deal with. As the members were aware, a ton of coal yielded approximately 24 lbs. of sulphate of ammonia, worth £11 10s. per ton. The best gas coal would return 2s. 6d. per ton for the sulphate, less the cost of acid, fuel, labour, and wear and tear, the total of which would come to about 1s. The return, therefore, from ammonia would be 1s. 6d. per ton of coal. The quantity of coal carbonized was undoubtedly small in the case of the person who put this question; but the liquor had nevertheless to be disposed of in some way that it would not become an absolute nuisance. The first thing was to construct a fair-sized tank and store the liquor in it, and then endeavour to educate the farmers in the district to buy it for manure. It could be used in this way by adding three parts of water to one part of liquor; and it was a good stimulant for young grass, barley, or oats when applied with a very fine rose. If it was put on the ground when the weather was dull, just prior to a shower of rain, it was very beneficial. Another method that could be adopted—and perhaps it would be more convenient—was to saturate a large heap of earth with the liquor, stirring up the earth from time to time. Then, at the proper season, the earth could be used as a top-dressing for any kind of crops, especially for grass plots. If they could only manage to educate farmers up to using it, it would be profitable to them as well as a great advantage to gas managers. It would be much better than always being under pressure from the municipal council to prevent the ammoniacal liquor from becoming a nuisance. A second method of disposing of it was by sinking a well to a fairly porous stratum. Then the liquor could be pumped into it and allowed to permeate into the earth. This was all very well so long as it did not get into a stratum that extended to other wells. They had also to be careful that all tarry matter was removed; otherwise the tar adhered to the sides of the excavation, and prevented the liquor getting into the earth, whereby it became really a storage-tank. The majority of the managers of small gas-works were in such a position that they must get rid of their liquor. If there was any swamp or creek near, it had to go in there, unless one of the two systems of which he had spoken was adopted.

Mr. W. Ray said he had works where he was carbonizing 800 tons of coal per annum. They were near the sea, and far from the main works. He had a well about 4 feet deep, and the ammoniacal liquor went into it, and had been doing so for the last 25 years; so he thought it was all right. In another works, where he was carbonizing 2300 tons of coal a year, he was beginning to cart the liquor to a place where it was converted into sulphate of ammonia. Where they had sandy soil, there was no difficulty in getting rid of their liquor.

Mr. E. B. Lee (Bairnsdale) said that during the time he was at Port Fairy they sank a well and turned the liquor overflow into it. The soil was sandy, and all the liquor was taken off. They were in the happy position of being able to dispose of all their tar, so that there was no trouble about it reaching the well. When he was at Brunswick, they used to get rid of a great quantity of liquor to the Chinese gardeners, who used it to kill slugs.

Mr. R. Bearup (Stawell) said at Stawell they were fortunate in having a drain into which the liquor was run. When he was at Hamilton, the head gardener at the Municipal Gardens used to come every year just before the chrysanthemums flowered, and get ammoniacal liquor for them; and he used to take prizes, both in Ballarat and in Melbourne, at all the shows of the season. The ammonia gave the flowers a perfect colour.

Mr. W. Pain said he had the honour of securing the champion prizes with chrysanthemums in the northern district through using ammoniacal liquor in the crude state—one part of liquor to six parts of water—for the flowers. So far as getting rid of the liquor at Bendigo was concerned, there was no difficulty. The creek there was a filthy place in the summer time, and they turned their liquor into it with the approval of the Municipal Council.

Mr. W. Swinburne said he should like to know whether there was any outlet for ammoniacal liquor other than through the gardeners. Did not the Ammonia Company take it?

Mr. Holmes Hunt said if they could concentrate it, he thought they could get a fair sale with the various ammonia companies.

Mr. Swinburne said that, in running the liquor into sandy soil, it was true, as one gentleman had observed, they had to be careful that there were no wells near, from which people were drawing water. A case occurred in North Queensland where ammonia was run into sandy soil at a point a few chains away from a place where an ice-works was drawing water from a well. After a time the ammonia percolated into the well, and the owners of the ice-works recovered from the Gas Company £500 damages.

Mr. Holmes Hunt remarked that the safest way of disposing of the liquor seemed to be that mentioned by Mr. Lord—to run it into a heap of earth, and afterwards use the earth for top-dressing.

Mr. T. Lord said there was in Sydney a firm whose representatives assured him that if he would get a little plant that was required for concentrating the liquor he would obtain from it a return of 7 to 7½ per cent.

Mr. D. Warren said he had a main drain close by his works, and the Footscray Council were very glad for him to run his liquor into it. In fact, they were rather annoyed if he deviated from the practice of putting it there.

Mr. Holmes Hunt said there was rather an important point with regard to concentrating ammoniacal liquor, and it was practically on a par with getting coal from one district. The ammonia people were taking it from many works in New Zealand and elsewhere; but after starting by paying a fair price for it, they were now paying only about half of what they first gave.

Mr. Ray remarked that if the members placed themselves in the hands of this philanthropic company they could make their minds easy that they were not going to make money.

Mr. R. O. Thompson said that for small works in the country he knew of no better way of getting rid of liquor than by weakening it and letting it go.

Mr. D. Warren said that if they put it on cabbages or flowers, and waited for a shower of rain, they would very likely kill the cabbages or flowers unless they used it in the proportion of about ten parts of water to one part of liquor. They could use this mixture with safety.

(*To be continued.*)

AN ACOUSTIC WATER-FINDER.

In a paper submitted to the Paris Academy of Sciences a short time ago, MM. Diénert, Guillert, and Marsee described an instrument invented by M. Daquin for locating underground water by means of sound. It consists of an acoustic trumpet furnished inside, at the lower part, with a small cone, the base of which is turned to the narrow top of the trumpet. M. Diénert has added a double lining covering the interior of the instrument, to prevent the outer air from causing a noise by blowing against the sides, which would deaden the sound caused by the flow of the water. The instrument is used in the following manner: A hole from 8 to 12 inches deep is made in the ground, and the trumpet is placed in a vessel containing water. The base of the instrument is slightly covered with earth, and the ends of the rubber tubes with which it is furnished are brought up to the ears of the operator. Should there be water underground, a continuous sound will be heard, like the noise of wind in a forest. The sound is considerably increased when the water falls into a gallery. This was noticed particularly in an impounding gallery 6 ft. 6 in. below the ground level, where the sound of water at a depth of 165 feet on either side of the gallery was distinctly audible.

By the co-operation of the officials of the Paris Water-Works Department, some experiments were carried out with the instrument near the Avre aqueduct, at four different places between Vaucresson and Garches. The first test was made at a spot opposite Vaucresson, in a well about 200 feet deep, where there was a spring delivering rather more than 2 gallons per minute. It descends through a pipe to about 32 inches from the bottom. At this place the instrument gave the dull rumbling sound of underground water for a distance of quite 500 feet on either side. At the second spot, the water was 145 feet below the ground; a spring delivering 2½ gallons of water per minute, which fell through a pipe to a distance of rather more than 3 feet from the bottom. In one of the two experiments made here, infiltrations to the ground were detected; the fall of the drops sounding like the strokes on a bell. At the third spot, there was a well about 86 feet deep; but, being near a road, the noise of passing vehicles drowned that of the underground water. Near the Garches Railway Station, there was a well of which the mouth was 10 feet below the surface of the soil. There was no fall; but a little barrier, causing a ripple, was distinctly heard through the instrument.

It would be of interest if further experiments were made, and careful records kept of the results obtained. As at present made, the instrument, which is named the "Acoustèle," acts only in the presence of running underground water, or, at all events, of water making a noise. The problem of water-finding by means of the divining-rod or some similar means has not yet been satisfactorily solved; and therefore further investigation should be encouraged.

Sir W. B. Richmond, R.A., will open the Smoke Abatement Exhibition at Sheffield, to which reference was made last week, on the 1st prox. The conferences to be held in connection with the exhibition will be presided over by Sir John Bingham, Sir Charles Skelton, and Mr. H. J. Wilson, M.P.

FILTRATION AND PURIFICATION OF WATER.

At the Meeting of the Institution of Mechanical Engineers on the 15th ult., Mr. JOHN DON, of Maybole, the author of the paper on "The Filtration and Purification of Water for Public Supply," which gained the first "Water Arbitration" prize, directed the attention of the members to the principal features of the paper, an abstract of which was printed and circulated. The subject was dealt with under four sub-divisions: (1) Sources of supply; (2) impounding; (3) filtration; and (4) distribution.

SOURCES OF SUPPLY.

The author began by pointing out that it rarely happens that a catchment area is entirely free from the possibility of contamination by sewage, manures, or other decaying matters deposited on the surface. Therefore water undertakers should, if possible, acquire the full possession of lands lying near the principal conduits, as well as of a considerable area adjoining the reservoirs. It should be planted, and the streams kept free from weeds, and the flow of water freely exposed to the air. The drainage of habitations within the catchment area must be rigidly excluded; and the water manager should periodically make an examination of intercepting drains and conduits, in order to satisfy himself that the precautions are effective under all conditions. If agricultural pursuits have to be tolerated within the catchment area, these should be restricted to grazing. In any case, the use of farmyard manure and town refuse as top-dressing is very objectionable, and can hardly fail to import polluting matters into the stream. Mineral fertilizers may be allowed if any concession upon this point has to be made. Water proceeding from marshy ground is in no case to be recommended. In the first place, it is of the nature of stagnant water, and holds the products of vegetable decay, and, secondly, it teems with insects and animalculæ, dead and alive. Water from peaty grounds is discoloured, and, from the presence of peaty acids which it invariably carries, it is able to dissolve lead. These ingredients may be removed by precipitation with alum and other chemicals; and if this be properly attended to, the supply may be rendered perfectly wholesome. Numerous towns in England are supplied from deep borings. In all undertakings of this nature, the same considerations apply with regard to the area surrounding the wells as in the case of catchment districts. A knowledge of the geology of the country will enable water authorities to determine the extent of land which they should have under their control.

IMPOUNDING.

Passing to the subject of the impounding of water, the author remarked that storage reservoirs fall into several classes, not only in reference to their capacity relative to the daily demand, but also in regard to the admission or exclusion of light, and to the arrangements whereby their contents are either left comparatively still, or are forced to travel from compartment to compartment. The rate at which sedimentation goes on in impounded water is an interesting question which suggests many lines of useful investigation. The time of descent of any given particle depends upon its size, its density, its form, and, above all, upon the speed with which it is being carried forward. Where the sediment is fine and the storage capacity not very great, subsequent filtration must be depended upon to complete the purification. The oldest and most natural method of forming a reservoir is to dam up a stream which is enclosed by rising ground. Here the chief causes which militate against the acknowledged benefits of impounding are to be looked for, in the growth of water-weeds, algæ, &c. In soft waters, plant species of a low type vegetate very actively, and cause many objectionable results. The water carries away products of their decay, which become noticeable to the consumer both from the visible turbidity and from the attendant odours. Much may be done to obviate these evils by judicious construction of the impounding dam. Roofing over is the perfect remedy, for plants of the species mentioned will not grow in the dark; nor do they flourish readily in water which is kept in motion. When the case to be dealt with is a reservoir exposed to the light, in which the water rests for many days, the dam should be as deep as possible (not less than about 30 feet), so as to discourage bottom growths. The slope of the side should be steep, so as to diminish the shallow margin on which the algæ find an attachment, and the borders are to be kept clear of grass. To a depth of 10 feet below the probable water level they should be pitched with set rubble or lined with concrete, and deeper still with loose stones. The result of many investigations is the discovery that the algæ may be destroyed by the application of a chemical which need not impair the potability of the water. Salts of copper, even in very dilute solution, are algicidal. One part of the sulphate in ten millions of the impounded water will serve to extirpate the algæ and leave the water clear and limpid. This has been confirmed by numerous successful experiments in America, England, and elsewhere.

With regard to settling reservoirs, it is usual in America to have three or four compartments arranged either in a rectangular form or in a crescent. From the raw-water basin, the flow takes place over a dividing wall into the next, and so on. At the waterworks of the Compagnie Général of Paris, the settling-tanks are so constructed as to induce continuous and progressive sedimentation. Notable for its ingenious construction is the Sundridge Park covered reservoir, which is laid out in concentric channels. The water circulates first in one direction and then backwards in the next conduit inwards. There is a slight fall from the periphery to the centre, where the outlet is placed. The assurance of the water engineer that this reservoir, as well as those of similar construction at Eltham and Knockholt, "works admirably," may be accepted as good evidence that the principle of their construction is sound.

FILTRATION.

Starting with a filter-bed constituted of layers of gravel and sand, graded from coarse to fine upwards, and all thoroughly clean, it is known that for a time it does not intercept any of the microscopical germs, and only an inconsiderable portion of the less minute organisms and of the suspended silt. As its operation continues, the ratio of suspended matters which escape to those which are retained decreases gradually, until after the lapse of a certain time it becomes almost a vanishing quantity. The reason for the gradual improvement in the purity of the effluent is not far to seek. Sediment accumulates upon the surface of the sand; it covers the surface of the granules in the top layer; and loosely plugs the intervening channels. Distributed all over this film of silt are numerous minute forms as algæ, desmids, and bacteria. The upper surface of the sand is transformed into a loose and more or less permeable matting of vegetable filaments, mostly lying quite superficially, and only invading the sand to a depth of a few inches. When this felt-work has attained to a certain consistency, the water which escapes through its interstices is denuded of sediment and even of bacteria to a very large extent. It is not the minuteness of the openings alone that contributes to the arrest of bacteria. From the experience of the "roughing" filters in the water-works of Paris, it appears certain that a large percentage of microbes (sometimes as much as 90 per cent.) fails to escape from the fourfold percolation of beds furnished with comparatively large particles, ranging in size from 1 inch to 0·2 inch in diameter. The fact being established that rough strainers do catch a large percentage of the minute forms, we are not left in doubt that the same occurs in the ordinary sand beds. After they have donned their slimy covering, they constitute one of the agencies by which bacteria are removed. Returning to the felt-work of algoid growth, it can readily be seen that a similar office is performed by the interlacing filaments. The minute strands with their slimy coating capture bacteria just as the threads of a spider's web catch insects. Here, then, we have the second agency for intercepting the bacteria. When it is remembered that these two agencies operate mostly in the upper layers, one can deduce that a second filtration is likely to prove more efficacious in the treatment of refractory filtrates than would have seemed to be the case at first sight. Experimental study of the natural history of the filter-bed has brought to light yet a third cause of the important check which the sand filter imposes upon bacteria which frequent its surface. Dr. Strohmeyer has shown that green algæ are energetic destroyers of minute germs, acting upon them in all probability by means of the nascent oxygen which they evolve.

Passing on to consider the disadvantages of sand filters, the author pointed out that there are prominently three. First, the rate of filtration is slow. In the second place, the cleaning of a bed which has become clogged entails considerable expenditure of time and labour; and the contact of labourers' feet with the filtering-bed is objectionable. The top layer must be scraped away to a depth of about half-an-inch, and fresh sand substituted. Thirdly, there is a loss of time and of water after the run is restarted. In cold weather the filtering skin forms more slowly, and in summer the rapid increase of algæ necessitates frequent cleaning. The author gave the following regulations for the construction and management of slow sand filters:

1.—The surface of the filters should be of such dimensions that there is a sufficient reserve to ensure the delivery of the necessary supply under all conditions of the raw water.
2.—There should be two or more beds, so that cleaning may be done without wholly interrupting the work of purification.
3.—Each filter-bed should be provided with a regulator, so that the velocity of the flow may be under control.
4.—The effluent should be readily available for sampling as soon as it leaves the filter.
5.—Bacteriological analysis should be made periodically, more especially after cleaning, and after filtered water has been allowed to pass into the service reservoirs or mains, and under all conditions which appear to be abnormal.
6.—There should be determined, by exhaustive experiments, the time that ought to elapse between the cleansing of a bed and the delivery of the effluent to the service reservoir.
7.—The thickness of the filtering layer should be sufficient for the local conditions, and never less than 16 inches.
8.—The walls and floor of the filter must be watertight.
9.—There should be appliances for the proper washing of the sand, and, wherever practicable, the contact of the workmen with the material should be avoided.
10.—Special regulations should be drawn up for the management of the filters in cold weather, more especially in times of frost.

In order to estimate the relative and comparative merits and demerits of the several forms of improved and mechanical filters which the author intended to review, he said it would be necessary to formulate a standard of purity of the filtrate, which had received authentic recognition from a quarter worthy of respect.

The following, so far as concerns the standard of purity, might be regarded as essential: (1) The number of bacteria per cubic centimetre to be under 100. (2) The water must be clear, and free from taste and smell.

Compared with slow sand filters, Jewell low-pressure filters possess the following great advantages: (1) Capacity to treat very turbid waters and to remove colour. (2) Occupy a relatively insignificant area of ground. (3) Freedom from risks of objectionable growths, and from the tastes and odours they impart. (4) Rapidly and easily and cheaply cleansed, without risk of contamination by workmen. Very similar to the Jewell filter in its leading principles is the Bell filter. The precipitant employed is the same, and the device for washing the sand when it becomes clogged is only a little more elaborate than that of the American invention. In this, the head varies from 6 to 14 feet—that is to say, it does not exceed a pressure of 7 lbs. per square inch. The Bell filter is usually operated under a pressure far in excess of this limit; but it works with a less powerful head if needful. Messrs. Bell affirm that the consolidation of the granulated quartz in their filters, owing to the high pressure, does much to perfect the efficiency of the apparatus. The filter possesses all the distinguishing traits which mark the efficiency of its American rival. It removes peaty acids when these are present; and it deals effectively with fine silt. As a result of bacteriological analyses of its effluent, as tested at Banbury by Professor Frankland, the filtrates were pronounced to be "of a very high degree of bacterial purity;" the *bacillus coli* being reduced from 10 per cubic centimetre to 1 in 10 cubic centimetres. The construction of the Reeves (Mather and Platt) filter does not differ greatly from that of the Bell filter. Coagulants may be brought into use if so desired. The filtering material is crushed quartz, and the size is graded—a layer of finer particles being at the top and of coarser below. The filter is constructed to act either with pressure or with a deep head of water.

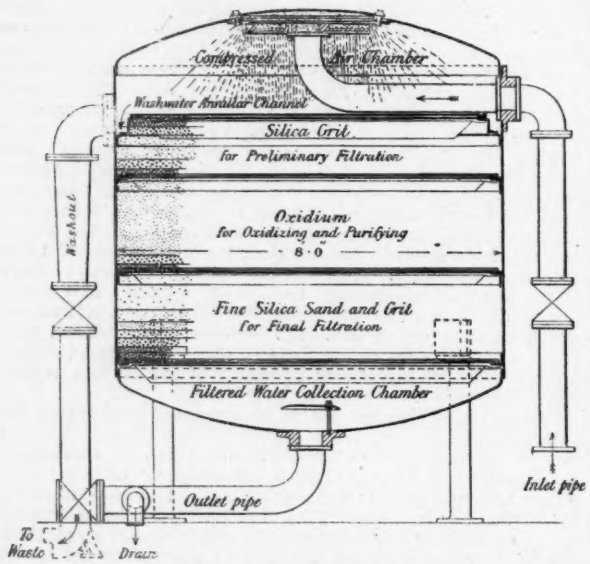


Fig. 1.—The Candy Filter.

Against the use of coagulants there have been urged from time to time various objections—some rather fanciful, others more real. There is the question of expenditure, representing an outlay of 5s. to 10s. per million gallons filtered—6s. on an average, per grain per gallon, per million gallons. It is recognized that it may be beyond the ordinary attendant of a filtering plant to determine the exact amount of coagulant that should be added under varying conditions of the raw water. Oxidium, which is the effective medium of the Candy filter (see fig. 1), is a porous composition of iron oxide, silica, &c., which exhibits properties similar to those of spongy platinum. Consisting largely of iron and silicates, the oxidium absorbs oxygen from the air, and yields it again to organic matters suspended or dissolved in the water under filtration. Living germs are intercepted as efficiently as in any of the filters described. It appears that wet combustion proceeds rapidly as the water percolates. The oxygen is supplied from the pores of the oxidium, wherein it is occluded. The stored oxygen is gradually used up as filtering goes on; but it is easily renewed by emptying the cylinder and admitting air. By simple means, a large volume of air is compressed into the dome of the cylinder, so that the descending water is well aërated. Dr. Thresh has made many analyses of the effluents of these filters, and the purification in general has been shown to be admirable. Practically speaking, there is no escape for pathogenic bacteria. Albuminoid ammonia is reduced to an insignificant amount; nitrification makes great progress in passing through the layers of oxidium; iron salts in solution are wholly got rid of. These are conclusions which may be drawn from Dr. Thresh's investigations. Similar in construction, filtering medium, and operation is Candy's polarite filter.

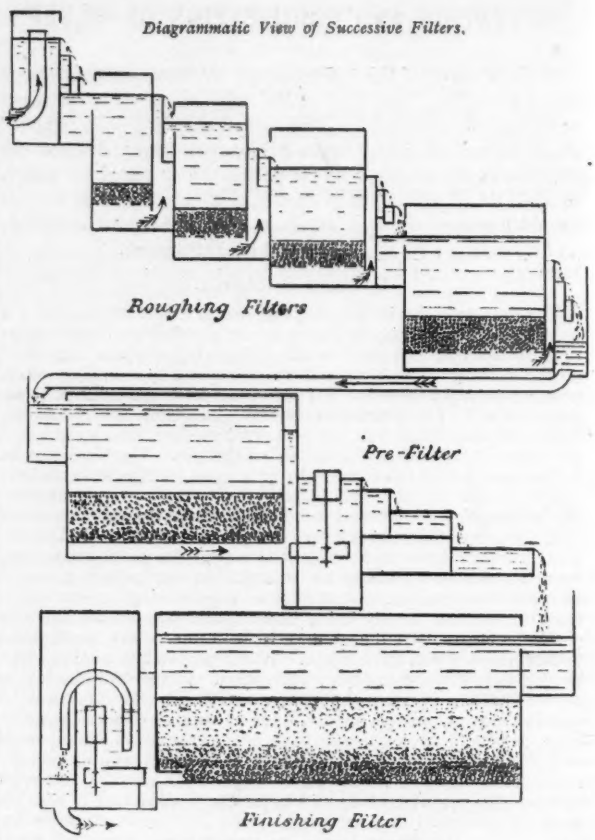


Fig. 2.—The Puech-Chabal Filter.

The construction of the Puech filter (fig. 2) is altogether novel. It is not, strictly speaking, a mechanical contrivance, but rather an adaptation of the older system, in which the sediment charged water is subjected to graded filtration. In a series of beds, the filtering substances range from coarse to fine. First is a battery of "roughing" filters, with four compartments. In the first the whole of the filtering medium consists of pebbles of the size of walnuts; in the second, they are comparable in dimension to hazel nuts; in the third, the grade is that of beans; while in the fourth it descends to that of peas. The depths of the layers are respectively 12, 14, 16, and 16 inches; but these thicknesses may require to be varied according to the character of the water treated. Naturally the water finds its way more easily through the coarser materials; and accordingly the area of the first filter is smaller than that of the second, and so on. Thus the speed with which the water percolates decreases rapidly from one compartment to another, being five times slower in the last than in the first. It is claimed that the suspended impurities are arrested by the filter throughout the whole depth of each bed. Dr. Kemna stated, in his notes upon the working of an experimental plant 10 metres square, that the action of the Puech-Chabal gravel strainers was very effective as a preliminary treatment for river water.

Judging from the bi-weekly reports of the Observatoire Municipale de Montsouris at Paris, the efficiency of the system leaves nothing to be desired. The Seine water at Nanterre after treatment by it is from week to week superior in freedom from bacteria to that obtained by other processes at Neuilly, Choisy-le-Roi, and St. Maur. At Magdeburg, the Puech filters were applied to the purification of the water of the Elbe, which is notoriously polluted with sewage and other offensive materials in greater or less amount; and its success has been beyond question. It is an open question whether the Puech filter plant is not over-elaborated. No film forms upon the finishing filters; but the water in these is in summer loaded with vegetable matters which have to be skimmed away by manual labour. Neither Dr. Kemna nor Dr. Thresh seems to be satisfied that the filtering film can be safely or advantageously dispensed with.

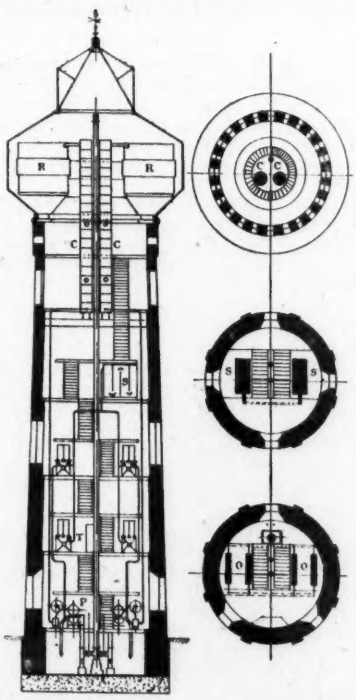
Coming to the subject of the purification of water by ozone, the author pointed out that ozone is best prepared by the silent discharge of high-tension electricity through perfectly dry air. There are many devices for ozonizing air; but most of them are adaptations of the Siemens ozonizer familiar to all students of physics. One now in use at Wiesbaden was designed by Messrs. Siemens and Halske. The air drawn on to it is dried by contact with a hygroscopic substance (such as $CaCl_2$), or preferably by refrigeration in a chamber cooled as in freezing-machines. More recently an ozonizing installation has been set up at Ginnekin, in Holland, for the purpose of purifying the water drawn from the River Mark (see fig. 3). Normally this stream is discoloured, and the number of germs per cubic centimetre is generally about 6000. Its course lies through fields which are frequently manured

TABLE *showing the Comparative Cost of Various Filters with regard to Capital Outlay and to Working Expenses.*
[Unit of Quantity considered: 1,000,000 gallons per diem.]

—	Jewell.	Bell.	Candy.	Puech.	Reeves (Mather and Platt).
Capital outlay	£4500	£2500	£2220	£7740	£6500
Filtering area	454 sq. ft.	302 sq. ft.	318 sq. ft.	35,000 sq. ft.	1000 sq. ft.
Mechanical power	10 B.H.P.	2 B.H.P.	None.	None.	None, unless desired.
Maintenance (not including interest)	12s.	10s.	2s.	10s.	Not definitely stated. May be about same as for Bell.
Filter washing, how often?	Once or twice daily.	Once daily to once in three days.	Same as Bell.	Part weekly, part monthly, part yearly.	Once per day, as a rule.
Free run of the filter after washing	15 minutes.	With extra alum added, a few minutes.	A few minutes.	Time required to fill the filtering basins—*i.e.*, a few minutes.	Three to five minutes.
Percentage of water required for washing	2½ to 5 per cent.	1 per cent. or less, often ½ per cent.	½ per cent.	Varies with the condition of the raw water, 2½ to 3 per cent., as a rule.	About 2 per cent.
Life of the filter	50 years.	Equal to the life of a steel bridge.	50 years.	Equal to the life of slow sand filters.	Fifteen years as a minimum.
Arrangement for regulating the supply of any precipitant added	Special regulating taps are provided working under steady head.	A self-regulator is attached.	None required.	As a rule, no precipitant is employed. If necessary, a gauged tap is used.	Ball-valve regulator, or small pump from water motor on the main.

Note.—The above statistics may be accepted as substantially accurate, as they have been supplied through the kindness of the proprietors of the filters quoted. No service reservoir is supposed to exist, and the cost of one is not included in the estimates given.

from the farmyard. The water from the intake is first passed through filters. Lift-pumps raise the filtered water to a tank placed at the top of the sterilizing tower. This tank has a capacity of 45,000 gallons, and ordinarily the pump delivers 4500 gallons per hour. The whole purifying apparatus is housed in the tower. Electricity is obtained from a local installation, and the 100-volt current is transformed to operate at a pressure of 65,000 volts. The cost of working is about 38s. per million gallons. Costly as this process of purification may be, it is probably one which is well worth the sacrifice of a little money when it furnishes unexceptionable drinking water from a source like the River Mark, the waters of which have been justly described as discoloured, and execrable from a hygienic point of view.



C. Conduits. P. First-Floor Pumps.
O. Second-Floor Pumps. T. Transformer.
S. Third-Floor Pumps. R. Top Storey Water-Tank.

Fig. 3.—Sterilizing Tower at Ginnekin.

The experience at many stations with ozone purifiers indicates that a fair proportion of the ozone goes to waste. Different waters, of course, make different demands on the purifying agent; and it is recommended that tests should be made to determine the minimum quantity of ozone that can with safety be applied. Not only would this be in the interests of economy, but it would prevent traces of the ozone being carried to the consumer. The Howard-Bridge apparatus effects this useful purpose; and considering that it takes 1 c. to produce a gramme of ozone, there is good reason to be as sparing as possible with what is the most expensive of all purifying agents in ordinary use. The Howard-Bridge system has the further advantage over installations which use an air-compressor to force the ozone into the sterilizers, that it dispenses with that portion of the apparatus, and causes the flow of water to suck in the ozone. In the De Fries system of ozone purification, which has been tested at St. Maur on a large scale, the arrangements are somewhat similar to those at Ginnekin. The sterilizers are vertical inwardly enamelled iron cylinders, divided into many sections by celluloid sieves. The water and ozonized air enter together at the base, and the outflow is at the top. The plant can treat 6 million gallons of water per day at a little more than £2 per million gallons—this estimate including outlay on capital account. This is considerably lower than the cost at the German towns referred to, where the corresponding outlay to cover all expenditure runs to a figure twice as large.

When a mixture of chloride of iron and bleaching lime is added to water holding carbonic acid or carbonates in solution, a precipitation takes place, and at the same time a coagulant is formed which carries down the suspended matters. Free chlorine acts as a bactericide. After the application of these chemicals, the water being led to filter-beds is easily freed from suspended material owing to the presence of the coagulant. Residual chlorine is eliminated in settling-tanks. The amount of chemicals added to the raw water is small—viz., of chloride of iron 8 parts per million, and of chloride of lime 0·5 part. Oxide of iron is the coagulant; and if care is exercised in regulating the dose of the chemicals, the filtrate will not contain any trace of it. Chlorine is not so easily got rid of; for it is soluble in water to a very considerable extent, and its elimination ultimately rests upon the formation of chlorides. At the Paris Water-Works, there is an experimental plant on this system capable of treating 1000 gallons per hour. The results are stated to be very satisfactory; but the cost is relatively high, being about ¾d. per 1000 gallons, or upwards of £3 per million.

The author next dealt with what he characterized as the cheapest of all precipitants—viz., iron, suitably brought into contact with the water in a metallic state. In the presence of air and salts of lime, metallic iron rapidly forms a proto-salt which first dissolves in the water and then, becoming oxidized by further aëration, develops the coagulant which carries down organic matter and fine silt. This is the Anderson process, and the most important installation is that of the Compagnie Générale des Eaux in Paris. A cylinder is made to rotate by gearing. The inlet and outlet pipes are directed along the axis, and are connected to the cylinder by water-tight collar joints which permit of the cylinder turning. It is constructed of iron plate, and within are many laminar projections which serve to raise up the fragments of iron and allow them to fall into the water from above, so that quick oxidation results. The rotation is slow—one turn taking from two to three minutes. Air is forced into the space above the water by way of a curved tube, and the direction of the air current follows that of the water. The flow of this is so regulated that about 3½ minutes are required to traverse the cylinder, and in that time some 3 grammes of iron per cubic metre finds its way into solution. Small as the quantity is, it serves to coagulate the silt and organic matters suspended in the water. It is averred that there is a diminution of dissolved organic matter from the moment the water escapes from the cylinder. Further, it is held that any colloidal alumina in the raw water is coagulated by the salts of iron when these pass into the ferric state. On leaving the rotators, the water undergoes preliminary treatment in precipitating basins and decanting compartments, and finally reaches a finishing filter, where the residual iron oxide helps to form a "felting" which intercepts bacteria and sediment. The speed of filtration is greater than in British slow sand filters, and averages 8 inches per hour. Nevertheless the purification effected is superior to that of the average sand filter, for the action of the iron salts is in many ways a valuable supplement to the ordinary process. Of the bacteria in the Seine waters, 99·8 per cent. are removed; and though from 100 to 200 germs per cubic centimetre are left, they do not seem of a harmful kind. The district supplied by this installation is fairly free from enteric and similar epidemics. The cost of the whole purification process, including interest on capital, works out to 20s. per million gallons.

Reviewing this section of his paper, the author said: The main question at issue would appear to be whether the sand filter is to be displaced by mechanical substitutes in future water undertakings. The latter have many advantages, and are, on the whole, less likely to permit the escape of unsound water. The Puech system indicates a simplification of the method of working which will possibly be received with increasing favour, especially if the experiments now being conducted on the Continent are brought to a successful issue. The question of mechanical sand washing is attracting much attention at present; but, taking a broad view of the facts which have come to light in connection with the true action of the filtering skin, it would seem to be quite a debateable point whether a thorough cleansing of the sand forming the top half-inch of the bed is, after all, so very desirable. Clean sand acts merely as a strainer, and has no decided power of trapping bacteria until it has become coated again with viscous matter, silt, desmids, or algæ—*i.e.*, with the very matters that have been so carefully washed away. As yet no one has attempted to show that the fresh coating is in any way more "refined" or purer than the old one. Is it not possible that there is a happy medium in the process of sand washing, and that in clearing a filter that has become clogged it may be sufficient to break up the growths of algæ and wash off part of the dirt? If there be reason in this view of the case, the problem of sand washing in open sand filters would be simplified. Raking of the top layer followed by a back current of filtered water, would do all that is necessary. Much time might be saved by sparing a portion of the viscous coating of the particles, for the filtering skin would be able to re-establish itself more quickly. Be it remembered that it is not clean sand but dirty sand that filters, in the true sense of the word. Hence those who insist upon thoroughly washed sand, and also those who put much faith in particular qualities of sand from special localities, have probably overlooked the essential point.

Distribution.

Coming to the last sub-division of his subject, the author commenced by laying stress upon the fact that hardly less important than the purification of the water at the works is its distribution to the consumers undeteriorated by its journey through the mains and service-pipes. He pointed out that its passage from the reservoirs or filter-beds to the consumers' taps brings it into contact with pipes of iron and lead, both of which metals may, under special circumstances, find their way into the current, and very seriously impair the purity of the supply. Although lead is insoluble in distilled water, pure water containing air in solution acts upon the metal, and forms on the surface a deposit of $Pb(OH)_2\,2PbCO_3$. At the same time some part of the lead will pass into solution, probably in the form of acid carbonate. The presence of alkaline carbonates or of the silicate of lime arrests the solvent action of the water. In that case the insoluble hydrocarbonate (the formula of which is given above) alone is formed. This deposit is adherent to the surface, and tends to prevent any further action.

Water collected from moorlands and mossy grounds is usually soft and contaminated with vegetable matters, and in particular with humic and ulmic acids. Such water has an increased influence upon lead, and is capable of dissolving as much as 1 grain to 2 grains per gallon in twelve hours. Waters containing 0·01 to 0·03 grain per gallon have not as yet been proved to be detrimental to the health of the community. In general, the safeguards that have been adopted against the solution of lead have been the removal of peaty matters by alum or other precipitant, and the hardening of the water by the addition of lime. At Wakefield, where much difficulty was experienced in counteracting the solvent action of the water, 1 grain of chalk per gallon is introduced into the raw water, and 2 grains of lime to the same volume of the filtrate. The result of this is that the water now dissolves minute quantities of lead—only 0·03 grain per gallon in 12 hours. The lime which is applied to the filtered water at Wakefield is placed, after slaking and riddling, in a hopper with a perforated bottom, and jets of water, playing upwards from below, wash down the lime to the mixing-pan. From this, the water passes on to a series of settling cylinders, entering them from below and overflowing into a trough connected to the service reservoir. The chalk which is added before filtration is washed out of a hopper in the same way. The cost of materials and labour for this particular treatment amounts to about 4s. 6d. per million gallons.

Dr. Houston has experimented with many natural waters, and he finds a distinction must be drawn between "plumbo-solvency" and "erosion." Rain water erodes, but does not dissolve lead; while moorland waters do both. Many natural waters, and more especially hard waters, are in a condition which is protective against the solution of lead. Faintly acid moorland waters have but trifling erosive power; but Dr. Houston shows that they are often near the condition of being able to erode. This is shown very clearly by causing such waters to act for a time on bright lead, and then renewing the metal a few times. The small reserve of plumbo-protective substances which they possess is thus exhausted, and vigorous action follows. This is a new fact in connection with lead contamination; and the deduction to be made is that corporations using waters of this class would do well to ascertain what reserve of protective substances they can count upon in the supply.

The occurrence of a case of lead poisoning at Twyford, Hants., led to the unexpected discovery that a water which is normally without action upon lead may take up a dangerous percentage of it if the pipe happens to be conveying a current of electricity. In the case mentioned, the current was traced to a leak in the electric lighting wire in the house where the patient resided. A current of the same voltage was passed through a lead pipe filled with the house water for a number of hours, and it was proved that lead had passed into solution to the extent of 0·07 grain per gallon. Ionization is set going by a current of sufficiently high voltage, and some part of the metal passes into solution. It appears, therefore, that electric mains should not be placed in the vicinity of water-pipes, and that, in any case, care should be taken to see that the wires are properly insulated. It has always been a common practice to "earth" wires by joining up to the water-pipe; but there is obviously a grave danger in this procedure, more especially if the current is of high voltage.

Concluding Remarks.

In bringing his subject to a close, the author said: Water purification is a practical science of recent growth, but it ramifies into so many other branches of technology that workers in several distinct fields are periodically adding new facts to the increasing store of learning in connection therewith. The growth has been rapid, in consequence of the activity of the tributary sciences. The amateur and the man of empirical knowledge have had their day—their successes it may be, their blunders it is certain; but the future is for the technical expert. It is too vital an element in the health of communities, this question of the purity of the water supply, to be put into the hands of those of whom the very best that can be said is that they feel their way. We in Britain are less advanced than our Continental friends in the study of water purification, because the lessons brought home by the deadly results of contaminated water have neither been so frequent nor so incisive as in countries less abundantly provided with naturally pure water. We have been content to conserve our established processes and to accept results without seeking to probe too deeply into the cause of occasional failures or recurring divergencies. But Science is on the march, and under her silent footsteps all that is vague and crude and unreasoned will tend in time to disappear. With a more accurate knowledge of the intricacies of the purification of supply water, we shall be able to attain our ends with economy, and, what is more important, with certainty.

[The abstract was illustrated by 3 plates and 16 diagrams.]

Discussion.

The Chairman (Mr. J. A. F. Aspinall, the President-Elect) remarked that all present would agree with him that a hearty vote of thanks was due to Mr. Don. In preparing the original paper, of which the present one was an abstract, the water arbitration prize no doubt had an attraction; but while Mr. Don would benefit by the prize, those present would benefit by the relation of his experiences.

Mr. W. B. Bryan, Chief Engineer of the Metropolitan Water Board, congratulated the Institution and the author on the manner in which he had brought together the principal features connected with the large question of water supply, which was of great interest to the whole world. He (Mr. Bryan) did not know he could offer any remarks in the way of criticism, but he would make a few general observations in the order in which the author had dealt with the subjects in the *précis*. As to sources of supply, generally speaking he concurred with the author. It was quite evident that districts, from their varying geographical position, must have supplies varying in character—whether from rivers, upland gathering grounds, or from underground sources. Regarding reservoirs, the author had referred to several classes, and to some being roofed over as a remedy for plant growth. With storage reservoirs on upland gathering-grounds, holding from 100 to 200 days' supply, of course, it was quite out of the question to cover them on account of their great area and the considerable cost that would be involved. Water, however, once filtered, or water obtained from underground sources, should invariably be stored in covered reservoirs. In fact, by the Metropolis Water Act, 1852, it was put upon all the Companies supplying London with water to cover the whole of their reservoirs for filtered water within a certain number of miles of St. Paul's; and he himself was of opinion that water once filtered should not see daylight again until it came out of the tap to the consumer. The impounding of raw water in large reservoirs had proved to be of the greatest advantage; and the exposure of the water to sunlight and air had invariably improved the water especially from the bacteriological point of view. He must state that the experience of the East London Water-Works Company was that, by carefully sorting the water during floods, in one of their great reservoirs, after a quarter of a century's use, only a few inches of sediment were found when the reservoir was run dry during the drought of 1898. The number of bacteria in raw water had been proved time after time to be enormously reduced by storage. Settling reservoirs in most cases, especially in upland schemes, were also good; and storage reservoirs served the purpose well. He might mention, in passing, that the Sundridge Park reservoir designed by Mr. Morris was not constructed as a settling reservoir, as all the water pumped into it was deep-well water. But it was a most economical and excellent system of constructing a covered reservoir. Filtration was a very important matter in connection with river and gathering-ground supplies; and he merely proposed to touch on the fringe of it. The author had described the construction and working of open sand filters; and as his

(Mr. Bryan's) special department of the Metropolitan Water Board was responsible for the daily filtration of no less than 200 to 250 million gallons of water, it would be seen how much depended upon efficient working, and therefore great care was bestowed upon it. In passing, he might remark that the cost of filtration was very much less than was generally supposed. A few days previously, he looked up the cost of filtering in the late Companies' time; and the average for some years he believed worked out to about $\frac{1}{14}$d. per 1000 gallons. In other words, 14,000 gallons were filtered at the cost of 1d. He did not include in this, the interest on capital or sinking fund, but merely the working expenses, cleansing the sand, and providing new sand. With respect to the roughing filters, he quite agreed with the views of the author, by reason of actual experience in working a plant for a number of years made by Messrs. Puech, and put down by the East London Company to deliver about 10 million gallons per day. This roughing filtration acted very well; and the water was afterwards passed over ordinary sand filters. The result was the latter operated for a much longer time than they would otherwise have done had there not been pre-filtration by the Puech filters. With respect to the regulations for the construction and management of slow sand filters, he agreed in the main with the author's views. Certain of them might require modification according to local circumstances. Concerning mechanical filtration, this was a most interesting subject. These filters (with which some of his colleagues and himself had experimented during the last twenty years) had made considerable progress in the last decade or two; and they had proved successful both in cases of manufacturing and domestic supply. He believed, however, most exhaustive experiments had been made relative to the methods of slow sand filtration and mechanical filters by the Filtration Committee of the Pittsburg Commissioners. Their report occupied 350 to 400 pages, giving results and trials extending over a very lengthy period. The cost of the installations, working bacterial efficiency, loss of water in washing, the use of coagulants, and other details were contrasted under the headings of comparative cost, durability, simplicity of operation, &c. The Commissioners stated: "In view of the foregoing considerations, we find the adoption of the system of sand filters to be most advisable." It was significant also that, since then, the huge plants put down for Philadelphia and other great cities had been filters of the ordinary type. Nevertheless, he felt there was a future for mechanical filtration, in spite of many difficulties, one of which was the purification of the wash water prior to its being sent into running streams. Those water engineers who had to deal with filtration on a large scale knew the difficulties of purifying water which had come from the filters—the washing of the sand, and so on—to the satisfaction of the river authorities. If the amount of wash water was very much enlarged, as it always was with mechanical filters, there was an increased difficulty under this head. He hoped this would be overcome some day. With respect to the ozone method of purifying water, he had inquired into it very considerably the last eight or ten years. Like many others present, he had the advantage of hearing Dr. Rideal's paper the previous Wednesday before the Sanitary Institute; and he (Mr. Bryan) had seen the ozone process in operation in Paris six or seven years ago, and on a number of other occasions. The improvements in the cost of producing ozone and the cost of purification per 1000 gallons of water, had been such the last few years that he thought ozone for the purpose had a great future before it. Of the Anderson system, he also had a good opinion. He remembered 23 or 24 years ago, in conjunction with the late Sir William Anderson, trying some experiments on a scale equal to about ½ million gallons per day; and the results were very good indeed. He believed at the present moment fully 40 million gallons of water a day were treated by the Anderson process in the neighbourhood of Paris, and, he understood, in every instance with excellent results. There was only one phrase in the whole paper to which he took positive exception. It was that in Britain they were less advanced than their Continental friends in the study of water purification.

Dr. S. Beale pointed out that the author had referred to an opinion expressed by Dr. Thresh—his (Dr. Beale's) chief in the department to which he belonged at the London Hospital—that the filtering skin could not safely be dispensed with. This certainly was Dr. Thresh's opinion until recently; but experiments at the Bedford Water-Works showed conclusively that this film was not absolutely essential for efficient filtration. At these works there were sand filters that were fitted with sprinklers; and there was no surface skin, but the water was found to be very pure bacteriologically. The upper surface of the sand was so constantly disturbed by the sprinklers that the grains did not become adhesive; but about 1 inch below the surface the sand did soon acquire an adhesive covering. In such a case, of course, the upper filtering film became unnecessary. As to the Candy filters, they had made a number of experiments on them. In fact, they had examined nearly every mechanical filter on the market; and recently Dr. Thresh had had an opportunity of studying the process of rapid filtration in the United States. As the result of their observations, they were of opinion that no mechanical filter, without certain adjuncts such as alumina, could be depended upon to remove bacteria. Any of them at a certain stage would yield water of good bacterial purity; but if followed from washing to washing, the results were not very satisfactory. He was now speaking only of bacterial action. So far as peat clarification was concerned, probably all these filters, if carefully worked, would do this; but that was another matter. Dr. Thresh had recommended the Candy filters on numerous occasions for the removal of traces of iron, sulphuretted hydrogen, colouring due to organic matter, &c.; and the results left nothing to be desired.

Professor Henry Robinson, referring to an allusion made by the author to the identification of underground water, said that a few years ago he had to deal with a case in which underground water was being treated in an unfair way. He adopted the plan of putting lithia in the water passing underground, and for some weeks, he took samples of the water travelling from point to point, and was able to identify the water. The Judge who tried the case said the decision in Chasemore and Richards was iniquitous and preposterous. The case to which he (the speaker) alluded was the Dorking one. The fact of being able to identify water by lithia stopped two other cases with which he was connected.

Mr. Daniel Adamson made some critical remarks on the section of the paper dealing with ozonizers.

Mr. William Fox thought the author should have given information in his table with reference to the cost of sand filtration in relation to the various filters on which he had given some figures. What they would all like to be able to tell their clients when they came and asked what filter could be recommended, was that a certain type of filter was not only the cheapest but the most efficient. To do this, he wanted to know how the sand filters compared with the rapid ones. He did not know whether the figures included the cost of buildings, which were invariably required for these filters. If they did not, the cost must be increased; and this would bring it nearer that of sand filtration. If they took ordinary sand filters, filtering at the rate of 50 gallons per square foot per day (a good deal depended upon situation, slope of ground, and facilities for getting material both for building and filtering), they might take the cost of sand filters at £4000 to £7000 per million gallons. There was another point with regard to the rapid filters—that was, the quantity of water required for washing. So far as he could make out, these rapid filters were washed very quickly. The pressure was put on from the lower side for a few minutes; and as soon as the water ran fairly clear, it was reversed, and the filter was put into action again. There was no time allowed for running any filtered water to waste in the operation of washing, and there was no time allowed for the formation of any film which was generally accepted as being necessary for proper filtration. Nor did he see how any film could be formed in some of these filters. In the Candy filter, on the top of the sand there was a perforated plate which interfered with the formation of a film on top; but it might, of course, be formed below. Was it possible to wash these filters out by turning the filtered water in from below? Even if these filters were allowed to run for only half an hour after washing, it would mean at any rate 2 per cent. on the cost of the filter, in addition to, in the case of the Candy filter, the large quantity of water required for washing. What was really wanted, in order to compare these filters, was that mechanical filters should be put side by side with some well-established sand filtration works, and let them be operated for a considerable period, and proper observations be taken. Water engineers would then know whether they were justified in recommending sand filters (which might be expensive in the first instance), or whether mechanical filters were sufficiently efficient to justify them in giving up sand filtration. In evidence not long ago, he heard sand filters spoken of as being obsolete. If they were obsolete, then in Great Britain, as also in Pittsburg, they were pretty much behind the times; but he did not think water-works engineers invariably stated that the system was obsolete. The author set out the various advantages and disadvantages of sand filters; but, after all, the disadvantages were only a question of cost, with one exception as to the possibility of contamination when the filter was being cleaned. But, as a matter of practice, this possibility he thought did not arise as a practical question. Then against rapid filtration, there was the point that had been lost sight of in the paper—that was, as to the loss of head in passing the water through the filters. The Candy filter caused a loss of head of 12 feet, against possibly a few inches in the sand filters. This might mean in some cases all the difference between gravitation and pumping; but where pumping was necessary, it might put 5 to 10 per cent. on the cost. He believed when all these points were taken into consideration, though the first cost of sand filtration was greater, considerably greater than the first cost of rapid filters, it would be found that, when efficiency was brought into account, they in nine cases out of ten were not adopting something obsolete by going in for sand filtration.

Mr. William Morris said his name had been mentioned in connection with the reservoirs at Sundridge Park. These reservoirs were for water pumped from the chalk; and his object in circulating the water was to keep it fresh. When water was put into a reservoir, some of it might remain there for days or weeks; and when it came to be drawn out on the occasion of a great demand, people complained of its being flat. That was the object of the circulating reservoir.

Further discussion was adjourned.

According to "Nature," the seventieth birthday of Professor G. Lunge will be celebrated on the 15th of September; and a local Committee have undertaken to arrange a suitable commemoration of the occasion. Chemists who desire to attend should write to Dr. E. Berl, Sonneggstrasse 84, Zürich IV.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

South Metropolitan Gas Company's Rating Appeals.

SIR,—Your reports on the above matter extend the Gas Company's arguments against our accounts, but omit those advanced in our favour. We do not wish to occupy your space by extending these latter, but must point out a significant omission in your report of the 26th of January. We refer to the paragraph on the Auditor's "challenge" to the Company's Solicitors "to point out any specific items in the bills of costs which they alleged should not be there at all because they had been previously included in the commission." Thereupon, it continues, the Solicitors indicated "two" such specific items (the account consists of 69 items), promising others later on. The accounts have been under criticism for four months. We complain that the report then omits the Auditor's embarrassing reply that one of these items was obviously charged "*Nil;*" while the other he ruled as being appeal work and rightly charged as outside the contract commission for the "Quinquennial revaluation."

While the audits are *sub judice*, it would be unbecoming to add more; but at the close we may, in justice, ask space for our side of the facts, as meantime we have been subject to unfounded animadversions contained in your columns for years—for example, a former "leader" referring to our duty as valuers as "a scandal such as this really is demands a stern rebuke."

For the moment, we content ourselves with the remark that during the quarter-of-a-century the South Metropolitan Gas Company have resisted, by constant appeals, the rating authorities we advise, our figures and methods have always received the sanction of the Courts, and have been adopted and endorsed by the London County Council for general application. Specially the latest appeals threaten not only far-reaching consequences to the gas companies throughout London, but may extend to the Provinces also; indeed, in the gas interests it was unfortunate that these appeals were ever pursued.

That we always strive for peace is shown by the fact that, with a third of London in our hands, the appeals in our districts last quinquennial were restricted to ten out of a total of 2163 appeals in the entire Metropolis; while in the former quinquennial over the same area we escaped all appeals—even the South Metropolitan being assuaged for the first and only time in a quarter-of-a-century.

THOS. DINWIDDY AND SONS.

54, *Parliament Street, S.W., Feb.* 6, 1909.

North British Association and Railway Demurrage Charges.

SIR,—The proposed system of charge for detention of railway companies' waggons and of siding-rent for traders' waggons, as intimated by the Scottish Railway Companies, and which came into force on the 1st inst., has aroused very considerable interest, and caused grave concern to responsible officials of gas-works.

The imposition of such charges can only be considered as creating an unfair burden of financial charge, and also as causing such a condition of affairs pertaining to the supply of coal to gas-works as to render the latest scheme of the Railway Companies practicably impossible. The circumstances attendant upon the requirements of coal for gas-works are peculiar in themselves, and on an entirely different basis from that of most other industrial concerns. The several points of difference have already been dwelt upon elsewhere; but shortly stated they are: Gas-works have a 24 hours working day, and this, with Sundays included, for the seven days of the week; also continuous work at holiday time—at Christmas and New Year especially—demanding a regular and continuous supply, and this when at the holiday periods referred to the pits are idle, and no coal is being raised.

My intention in writing on the subject, however, is not to discuss the points at issue, but to find serious fault with the North British Association of Gas Managers, and particularly their Committee, because of their attitude of sphinx-like inactivity and silence on this important question. Enough has been stated to prove that the intentions of the Railway Companies, unless very materially modified, must necessarily bring about troublous and irksome conditions of management. The Association are supposed to preside over the interests of the members in their profession, who, in turn, endeavour to make their best effort on behalf of the concerns they represent. Life is too short for anger; but I do most earnestly submit that the initiative of negotiation with the Railway Companies, or of laying evidence before the Board of Trade, most certainly lay with the Committee of the North British Association. This they have failed to do, as might so easily have been done, by calling a special meeting of the members. Other trades and industries have already dealt with the matter by special meeting; but the gas industry in Scotland—and it the most seriously affected—is left lamentably without a voice, so far as our representative Association, in the hands of its officials, is concerned, and has allowed private enterprise to take its place. I must further, though with a lighter hand, give chastisement to our two recently-formed Commercial Sections. Surely this was an opportunity to show good cause for their existence and evidence of actual work.

Our position has not been allowed to remain uncared for, as, thanks to the splendid work of Mr. W. R. Herring, the meeting held in Edinburgh yesterday, and the appointment of a Committee to confer with the Board of Trade on Monday, the 8th inst., will result in the gas industry in Scotland being ably represented.

I have been thus constrained to write of the position of the North British Association relative to this question and to other subjects of importance in their broad aspect, and of what really is the duty of the Association in influencing and directing affairs that from time to time affect the industry in our own area. My endeavour may be fruitless; and, if so, I must contentedly reserve the belief that in this matter, as in other higher questions of the day, the power of the individual, as the single unit acting with a direct and positive force, is eminently more useful than the mass, either immobile or slowly moving.

Gas-Works, Alloa, Feb. 6, 1909. J. W. NAPIER.

Purification by Means of Ammonia.

SIR,—We are sorry to have to take exception to Messrs. W. C. Holmes and Co.'s letter, under the above heading, in your last issue; but as they have referred to our patent No. 28,387, of Dec. 24, 1907, somewhat aggressively, we feel compelled to do so, although adverse to newspaper controversy.

We observe that Messrs. Holmes state that their patent No. 7364, of March 26, 1902, "covers the same ground, as the arrangement for the removal of our brush-filling is identical with theirs." Casually read, one might assume that we used "brush-filling," which, of course, we do not. The arrangement for the removal of the washing "bundles" is, however, the point they evidently wish to emphasize as being "identical." But the only similarity consists in manholes being provided at the top of the washer-scrubber. In this connection, we may say that we fitted such manholes long before 1902, as many of your readers who have our machines will know; and we, of course, make no claim to novelty in this detail.

Our patent, however, covers a novel method of fitting and withdrawing the "bundles." But this is a minor feature; the "chief object" of the invention being "to ensure that the gas shall be caused to pass over the wetted surfaces" (*vide* your description in the "JOURNAL" for the 5th ult.), this object being attained by reducing the number of joints by half, and providing special means for preventing "slip" at these joints. If your readers will compare the illustrations, &c., given in your issues for Jan. 5 and the 2nd inst., they will see that, other than the manholes, there is no similarity in the two designs.

With regard to the Claus process at Belfast and Messrs. Holmes's proposal to use washer-scrubbers at different levels, your readers will know that there is nothing new in this. The writer, when inspecting the plant at Belfast in 1891, made a similar suggestion, in order to get over the loss of ammonia due to pumps leaking. Mr. R. H. Patterson was also in favour of this plan. It is quite possible that Messrs. Holmes (and others) will be able to improve on the "defective and badly-designed plant" at Belfast as they term it—rightly or wrongly we are not in a position to say, at this date.

We may add that the "arrangement for the removal" of the "bundles" shown in Messrs. Holmes's 1902 patent strikes us as being a good imitation of our old and present arrangement, so far as regards slotting the "bundles" at their narrow ends, and allowing them to rest over supports.

per pro Kirkham, Hulett, and Chandler, Limited,
SIDNEY HERSEY, Managing-Director.

Palace Chambers, Bridge Street, S.W., Feb. 4, 1909.

Price of Gas at Stockport.

The Mayor, Mr. Fernley, as Chairman of the Gas Committee, stated at the last meeting of the Stockport Town Council that the Committee had considered the question of reducing the price of gas to ordinary consumers, but had found that it would not be wise at the present time to make a concession. To reduce the price 2d. per 1000 cubic feet to all consumers would cost about £6304 per annum. The present price of 2s. 4d. net compared very favourably with other towns. It was necessary to give a reduction to large trade customers, because of the increased competition which the department had to face. Cheap gas had a tendency to attract industries to the town. Alderman Lees expressed disappointment that there had not been a reduction all round. He pointed out that last year the Gas Department made a profit of £29,000. Of this, £15,000 went in relief of rates, £3706 to the reserve, and £10,000 to the sinking fund. He did not think that relief should be given to about fifty manufacturers who used gas for trade purposes, while the great bulk of the consumers were left out. Mr. Hollis contended that nearly all of the £15,000 received from the Gas Department in relief of rates went to the large ratepayers. In reply, the Mayor said the town could not afford to part with the £6000 which an all-round reduction would mean. On the recommendation of the Gas Committee, the following scale of discounts, relating to the supply of gas to large consumers and slot-meter users, was adopted by the Council: Over 500,000 but under 1,000,000 cubic feet per annum, 1d. per 1000 cubic feet; over 1,000,000 feet, but under 2,000,000 feet, 2d.; over 2,000,000 feet, but under 3,000,000 feet, 3d.; over 3,000,000 feet, but under 4,000,000 feet, 4d.; 4,000,000 feet per annum and upwards, 5d. The allowances to be made in conjunction with the differential discounts on number of hours of working at present in force, but subject to the rule that the two discounts together shall not reduce the price of gas lower than 1s. 3d. per 1000 cubic feet inside the borough, and 1s. 6d. outside. That an additional discount of ½d. in the shilling be allowed to automatic meter consumers. It is estimated that these concessions will amount to about £1500 a year.

Gas-Meter Robberies.—There has seemingly been an epidemic of prepayment meter robberies at Nottingham during the past few months. At the last meeting of the City Council, Mr. Wade pointed out that about forty of these robberies had occurred since the end of October, and asked what steps the Watch Committee had taken. Sir J. T. M'Craith replied that these cases were very difficult indeed to prevent, because they had a very strong suspicion that in a great number of instances the robberies were committed by people connected with the houses in which they occurred. In proof of this, he detailed half-a-dozen convictions which had already been obtained. The police, he said, were fully alive to the matter. Special orders had been sent out; and detectives and plain clothes officers patrolled the districts in which the robberies had been occurring. Mr. Cook: Do the Watch Committee say whether these people are punished sufficiently when they are found out? A month's hard labour would do a great deal of good. Sir J. T. M'Craith: I dare not attempt to answer that question.

REGISTER OF PATENTS.

Production of Air Gas.

SHARPE, W. C., SEN. AND JUN., of Louth, Lincs.

No. 837; Jan. 14, 1908.

This apparatus, for the production of gas by mixing petrol or the like spirit and air, is characterized by the combination of a petrol or spirit tank, a carburettor, a pump for pumping the spirit from the tank to the carburettor, a series of combined air collectors and deliveries for collecting air and delivering it to the carburettor, and a gasholder. The pump has a connection to the petrol or spirit tank and another to the carburettor; while the air collectors and deliverers have each a connection to the carburettor and the carburettor a connection to the gasholder. The pump and the air collectors and deliverers are all operated from one common shaft—the pump by means of a cam acting on a lever to which the pump rod is connected, and the combined air collectors and deliverers by rods connected to cranked parts of the shaft and to the collectors, or else by toothed eccentrics connected with the collectors by chains passing over them and under toothed wheels on the tops of the collectors. The shaft is driven by rope and weight-driving gear through suitable gear-wheels, or else by means of a motor or other source of power.

To stop the rotation of the crank-shaft and, consequently, the supply of spirit and air to the carburettor when sufficient gas has been manufactured for the holder to contain with safety, the patentees arrange to mount a brake-wheel on the crank-shaft and a brake-block or band in such a position as to be normally out of contact with the brake-wheel. The brake-block or band is connected by a chain, rope, or the like to one end of a lever fulcrumed to a bracket carried by the frame of the apparatus, or some convenient fixture; the opposite end of the lever preferably projecting sufficiently far as to be pushed upward by the bell of the holder, or by a projection thereon, when the bell reaches a certain height. The opposite end of the lever lowers and puts the brake-block or band into contact with the brake-wheel, and so stops the rotation of the shaft.

Treatment of Gaseous Fuels.

COMPAGNIE DU GAZ DE LYON, of Lyons, France.

No. 2720; Feb. 6, 1908.

Date claimed under International Convention, March 1, 1907.

The patentees point out that most industrial gaseous fuels, owing to the large quantity of carbonic oxide they contain, have only limited employment in countries—such as France—where "special attention is paid to poisonous properties in gaseous mixtures supplied for domestic use." Moreover, their high density, resulting from their composition, "renders it more difficult to mix them with coal gas and to carburet them to the standard usually required, and at the same time reduces the distributing power of the system installed." Lastly, for the same reason, "when a considerable quantity of water gas is mixed with coal gas, it may become necessary to modify the regulation of the burners employed." For all these reasons, "it is desirable to reduce the proportion of carbonic oxide contained in the gases (industrial or lighting gases) by substituting for the carbonic oxide hydrogen or combinations of hydrogen and carbon while allowing as far as possible the hydrocarbons already present in the gases to remain unaltered."

This invention, consequently, relates to apparatus for utilizing the process by which gaseous fuel, especially water gas, is treated with steam in the presence of metals, their oxides, and salts (the carbonic acid formed being subsequently removed in whole or in part); and it has for its object "recovering the expended energy and heat which result from the manufacture of the gases and from their variations in temperature and pressure as well as the variations in temperature and pressure upon the liquids employed."

The superheated steam which exists in water gas, especially immediately at its outlet from the gas-generator, is utilized. After passing out from the catalyzer, the gases flow to refrigerators and washers, and are then treated for the removal of carbonic acid, after purification through oxide of iron for the elimination of the sulphurous products or after any other purification necessitated by the composition of the gases treated.

The specification continues: According to laws relating to the solution of gases in a liquid solvent, it is known that the weight of gas dissolved increases or dimin shes rapidly when the temperature is lowered or raised; further (law of Henry of Manchester), the weight increases or diminishes proportionally to the increase or fall of pressure. After the gases have been compressed, they are caused to circulate from bottom to top of a vertical saturation column, which the solvent traverses from top to bottom. The saturated liquid drawn off at the bottom of the column is directed into one or more low-pressure chambers in which the greater portion of the dissolved gases is evolved. The liquid is then brought back to the top of the column in a continuous cycle. The gases, while rising into the mass of liquid contained in the column, expand with a pressure dependent on the height of this column, and thus lower the temperature of the liquid—a temperature which the phenomenon of solution tends to raise.

The arrangement employed is shown (diagrammatically) in fig. 1; it being supposed that the difference in pressure of the liquid is obtained by gravity. It consists of a water-gas generator A, the gas from which is led through valves B^1 B^2 into the catalyzer C, containing oxide of iron; the pipes D^1 D^2 allowing the necessary admixture of steam. After their passage through the catalyzer, the gases are led through valves E^1 E^2 into a double heat interchanger F G towards the washer H.

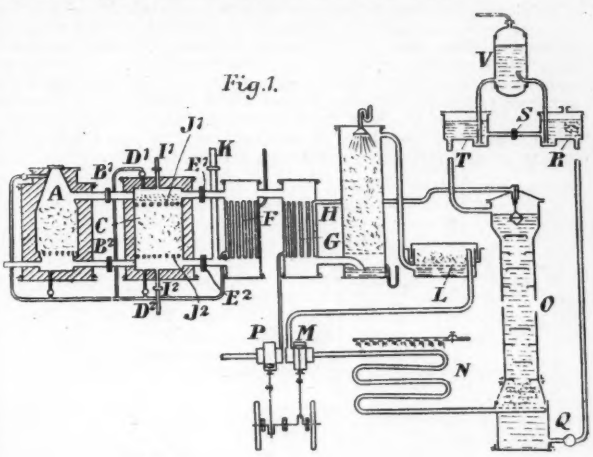
The arrangement shown represents a gas-generator of the Dellwik-Fleischer type, in which the operation of production may take place alternately from top to bottom and from bottom to top. Secondary air inlets I^1 I^2 are shown which, in starting, allow of heating the catalyzer to the temperature desired by burning at J^1 J^2 gas from the generator. During this period, the products of combustion pass out through the valve K.

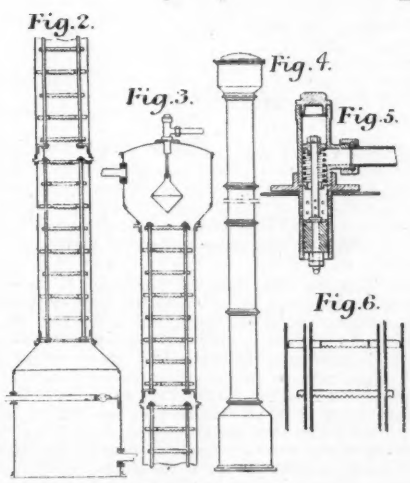
Gases passing out of the washer H pass into one or more purifiers L, to be afterwards compressed by the pump M. The gases are then led through a refrigerator N towards the bottom of the saturation column O. When freed from carbonic acid, the gases are expanded in the engine P of the pump M, after heating in the heat interchanger G. They are then ready for use.

The liquid charged with carbonic acid in the column O rises into the column Q R, whose height is such that the liquid takes its level in R under atmospheric pressure. The liquid having lost a portion of the carbonic acid with which it was charged is brought back into the saturation column through the pipe S, the reservoir T, and the downward column T U.

The liquid in rising in the column Q R is subjected to decreasing pressures, and, consequently, the dissolved gases form bubbles throughout its mass, the rise of which will facilitate the circulation of the liquid. In order to be able to properly regulate this circulation, and start the apparatus, a pump or compressed air injector (or merely a source of heat) is arranged at the base Q of this column.

As, however, the evolution of the dissolved gas will be rendered incomplete by the known phenomena of saturation, it is said to be advantageous to allow the pressure of the liquid to fall well below atmospheric pressure. For this purpose, in place of allowing the liquid to pass directly from R into T through the pipe S, this is effected by a syphon V, of such height that a vacuum is obtained in the upper reservoir of the syphon similar to that in steam-engine condensers.





Lyons Water-Gas Treatment.

Carbonic acid passes away in R, at a pressure near to atmospheric pressure; but, on the contrary, in V it should be sucked off by a pump or injector.

In fig. 1, the saturation column O is shown only diagrammatically. It is provided with baffle-plates or other means suitable for retarding the rise of the gases and prolonging their contact with the liquid.

A general view and details of a column for the passage of about 50 cubic metres per hour are shown in figs. 2 to 6. The column is provided at the top with a float, which allows the level of the liquid to be regulated by actuating the regulator for the outlet of the gases shown in fig. 5. Similarly, the reservoir R is provided with cascades, baffles, agitators, or other means for dividing the liquid mass, for the purpose of facilitating the evolution of the dissolved gases.

The syphon shown above for relieving the liquid from pressure is only given by way of example; but relief from pressure may be carried out in any pressure interchanging apparatus in which there are changes of pressure which allow the utilization of all or part of the available energy, and to employ it in particular to inject into the column under pressure either new liquid or liquid which has been used. In the same way, a true hot-air engine which utilizes the pressure of the gases passing out from the column O and superheats them at G (the pressure of these gases being nearly equal to the inlet pressure at O if the height of the column were lessened) is shown by way of example, as the engine P of the compressing pump M. But any other arrangement which allows this quantity of energy to be recovered or utilized to a

greater or less extent may be employed if it be desired to maintain the pressure of these gases.

For the same reasons, the interchanger F has been placed in the path of the hot gases passing out of the catalyzer. It may, in particular, serve to superheat the steam blown either into the gas-generator A or into the catalyzer C in such a manner as to increase the efficiency of these appliances.

The purifier L has been indicated. This may be used when it is desired to obtain pure carbonic acid; but if this is not the case, this purifying process may be omitted, especially as the impurities contained in the gases treated—particularly the sulphurous products—will be removed in the column O in the same manner as the carbonic acid; water being the only solvent employed.

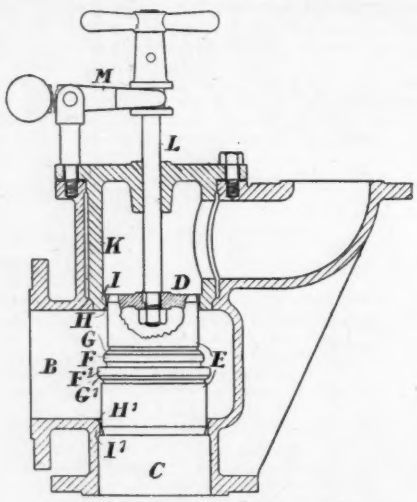
Lastly, it is to be understood, say the patentees, that the process may be combined with processes which exclusively utilize the variations in temperature of the liquids employed for washing the gases. The chambers R and V for evolving the gases will then be hot chambers at the same time as low-pressure chambers, and the saturation column O will be the cold portion and at the same time the high-pressure portion.

Bye-Pass Valves for Gas Plants.

BELLAMY, A. R., and JAMES, C., of Grantham.

No. 2716; Feb. 6, 1908.

This invention relates to bye-pass valves used in connection with either pressure or suction producer gas plants, with the object of enabling the generator—either when the fires are being blown up, or when the generator is in operation—to be put into communication with the scrubber and engine, or to have its connection with the scrubber and engine interrupted and be put into communication with a ventilating or chimney pipe in communication with the atmosphere. The arrangement proposed is such that the inlet to the scrubber must be closed before the inlet to the ventilating pipe commences to open, and *vice versâ*.



Bellamy and James's Bye-Pass Valves.

As shown, B is the inlet from the producer; C the outlet to the scrubber; and D the outlet to the ventilating pipe or chimney leading to the atmosphere. E is the piston-valve, having two diameters (though it may be made with only one diameter). F F^1 are the two peripheral projections upon the piston and having mitred or bevelled faces G G^1, which close on the mitred or bevelled faces H H^1 formed on the bored seats I I^1 on the casing of the valve.

The piston valve is in its middle position—the outlet C to the scrubber and the outlet D to the atmosphere (both being closed). On the valve being moved axially towards the face H, the outlet C to the scrubber is opened and the outlet D to the atmosphere closed and sealed by the bevelled or mitred face G. If the valve is moved axially in the opposite direction, the outlet C to the scrubber is closed and sealed by the mitred or bevelled face G^1. The mitred or bevelled seat is formed on a removable lantern K, so as to permit of access being had to the valve, which is operated by the spindle L and the weighted fulcrummed lever M.

Producer-Gas Plants.

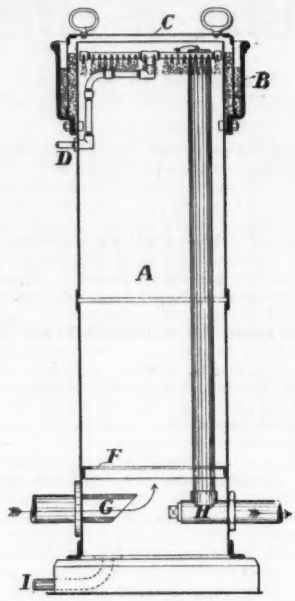
BLAKELEY, W., of Ravensthorpe, near Dewsbury.

No. 4492; Feb. 28, 1908.

This invention—relating to suction-gas producers and similar producing gas plants, wherein expansion boxes, hydraulic boxes, or seal chambers are used for providing a more uniform service of gas—consists in the application of a water-lute to the top of some part of the apparatus (such as the scrubber) for securing a variable capacity of the expansion chamber dependent upon the pull of the engine or pump and the quantity of gas being made.

The chamber A is filled with coke or other scrubbing material; B is a water-lute at the top of the scrubber; and C is the sealing lid which enables the annular space filled with water to be divided into two portions connected at or near the bottom—one communicating with the inner or working part of the scrubber, and the other being open to the atmosphere. D is the water inlet to the usual water-spreader at the top of the scrubber. G is the inlet for gas; H, the outlet for gas; and I, the outlet for waste water after passing through the scrubber.

The outlet pipe H being connected to the gas-engine, and the inlet G to the generator, gas is drawn through the apparatus at the outward



Blakeley's Producer-Gas Plant.

stroke of the engine by causing a partial vacuum throughout the plant, dependent upon the resistance to be overcome in the gas passing through the plant. This partial vacuum causes the water in the lute to alter its level; the water in the inner portion rising and the water in the outer portion falling. On the return stroke of the piston, when the connection between the scrubber and the engine is shut off, the water tends to again find its own level, and by doing so causes more gas to be drawn through the fuel. Thus by the time the piston of the engine is in a position for again drawing gas, the level of water has regained its original position.

This is the cycle of operations; and, by causing the gas to be drawn through the fuel even when the engine is not exerting a pull, a more uniform and steady make of gas is ensured, and the expansion and contraction of the capacity of the chamber—owing to the alteration in the levels of the water—enables the make of gas to accommodate itself to the varying pull of the engine. Another advantage said to be obtained by adopting the arrangement shown is that the lid can easily be removed at any time to examine the condition of the scrubbing material or water-spreader, and replaced for working in a short space of time.

Photometer.

FENNELL, W., of Wednesbury, and PERRY, W. P., of Tipton, Staffs.

No. 6971; March 30, 1908.

This invention has for its principal objects a simplification of "flicker" photometers, the best known type of which, the patentees suggest, consists of a wheel with edges facing the observer in planes at about 45° with the line of sight—these surfaces being one to the left hand, the other to the right. An eye piece with a lens focuses one spot at or near the middle of the wheel; and in one revolution the two surfaces are in succession brought under the lens, because the line of contacts shifts as the wheel rotates.

This type of photometer, they say, is subject to several sources of error. The exact angle which the sources of light make with the surfaces must be absolutely equal, or they must be known with great accuracy. If, therefore, the photometer head be turned a little out of absolute line, the one surface is brought more normal to the one light, and the illumination in the surface is increased, and on the other surface the illumination is diminished. "In fact, the smallest out-of-line effect makes an enormous error in result." Further, it is difficult to make the white surfaces at equal angles and of equal whiteness. Again, the slightest out-of-truth of the wheel causes a bias. Also the method of finding the angles which the lights make with the wheel has to be very delicate. The net result is "a very expensive construction."

According to this invention, the bulk of the objections named are overcome by the use of a translucent material illuminated on the sides and observed on the edge.

Fig. 1 is a diagrammatic plan and end view of this photometer having a disc of two wedge-shaped parts. Fig. 2 is another form, showing the opaque film arranged to cover the sides of the disc alternately. Fig. 3 is yet another form in which the opaque discs revolve on either side of the translucent material. Fig. 4 is a front elevation of the sighting arrangement by which the angles with lights may be read.

In fig. 1 is shown two separate pieces of translucent material A B (such as paraffin wax) each illuminated by one source of light—these pieces being shown as wedge-shaped discs, separated by the opaque film C. These are in succession brought under observation. Two wedge-shaped discs are carried on a shaft S; and, in rotating, both discs come successively under observation. The two lights X Y, which are to be compared, are placed in a line parallel (or nearly parallel) to the shaft carrying the compound discs. A fixed eye-piece D is focussed on to one spot on the periphery of the disc; and the two lamps and a given position near the edge of the disc are kept in a straight line, or nearly so.

In fig. 2 only one translucent disc A^1 is used, which has parallel sides, and is provided with two opaque films C^1 alternately cut away on either side of the disc, so that no section of the disc is covered by more than one film at a time. It is preferable to slot the edge of the

disc, and insert in it an opaque cross piece C^2, which may separate the disc into four parts as shown.

It will be seen that these two forms have the same characteristic—viz., that the translucent material revolves, and that they are provided with opaque cross-pieces at the point where the opaque discs register on either side of the translucent material. Thus the arrangement may be likened to a number of teeth, alternate teeth being illuminated entirely from the diverse sources—thus obviating, it is said, the difficulties previously enumerated. It is important, however, the patentees point out, that the material used for the translucent parts shall be uniform—that is, all parts equally illuminated edgewise with equal illumination on the sides.

This remaining difficulty is, it is claimed, overcome, and all the objections set out earlier are removed by another modification—fig. 3. This consists in the illumination alternately of the sides of one piece of translucent material A^2, which need not (and preferably does not) revolve, by using two opaque revolving discs C^3, each carefully cut to allow the light to be shut off, and to pass through for alternate periods from the two sides. Between the revolving discs is fixed the stationary piece of material A^2 (such as paraffin wax). The discs are set so that when light from the one side passes the other is shut off, and *vice versâ*.

The precautions to be taken are simply to secure a fairly uniform piece of translucent material, to keep it thin, and to keep the opaque discs as close as possible to the material, as avoiding fringing or double illumination where the edges of the opaque discs pass the eye-piece.

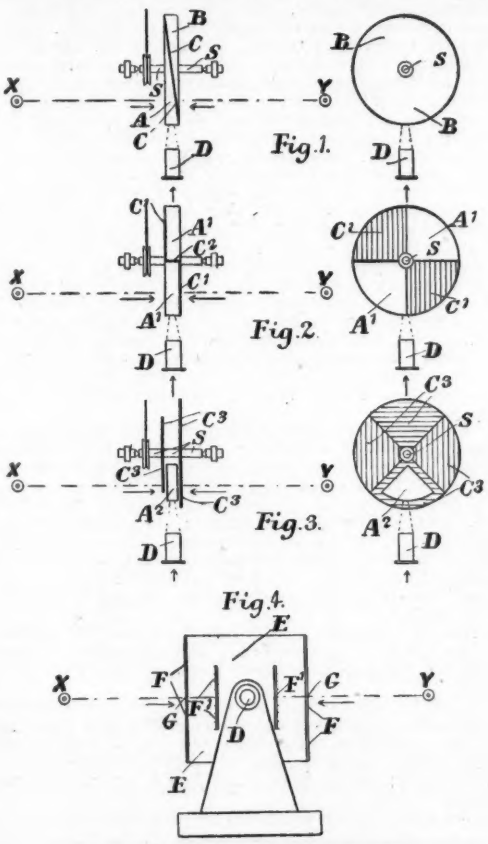


Fig. 4.

Fennell and Perry's Flicker Photometer.

The opaque discs should also project beyond the material, so as to shield it from stray or edgewise illumination. It is advisable to protect the wax by thin glass or mica sheets, so as to prevent the adhesion of any dust.

A solid translucent material may sometimes be substituted for a transparent vessel, such as glass, in which a translucent liquid is held—particularly for analyzing the colours in various lights, as the edgewise diffused illumination produced by the side illumination will be in terms of the colour of the liquid. This has the advantage of not absorbing the lights to different extents as is the case with photometers, where two screens (which may and do vary in practice) have to be used. As one piece of material only is illuminated, there can be no error by reason of different absorbtive properties of different materials. The comparison is practically independent of uniformity of material, and it is easy to secure uniformity in this respect. Again, as the material is stationary, any error from eccentricity is absent, as the edge must always be equally near the eye-piece.

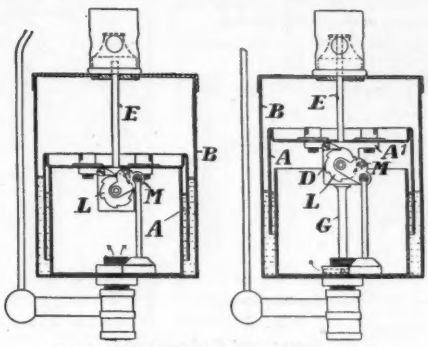
A further improvement in the construction of photometers consists in a sighting arrangement, by which the angles with lights can easily be read. The photometer head consists of a box E swung on the tube of the eye-piece D as a centre, and which can be rocked round this centre as in fig. 4. To ensure accuracy the plane of the disc must be at an angle midway between the line of the two sources of light. The two flaps F are arranged on the outside of the box each equally distant from the centre of the disc, and preferably parallel to the sides of it, and each containing a pinhole G, which throws an image of the source of light on two inner flaps F^1, also equally distant from the centre, and with a scale marked on them. It is only necessary to see that the images occupy similar positions on the scales to know that the lamp angles are equal. The inner flaps may be used to close the photometer when not in use. It is desirable, but not necessary, to have the pinholes and the centre zero of the scale all in a line with the centre of the eye-piece, as all angle measurements are then absolute.

Actuating Gas-Cocks by Variation of Pressure in Mains.

SPARKS, E., of Tufnell Park, N.

No. 8690; April 21, 1908.

As pointed out by the patentee, it has already been proposed to provide the gas-plug with a number of passages equally spaced out and with corresponding ratchet teeth, which are engaged by a pawl lifted by a rod extending above the piston, so that each time the piston rises the pawl pushes onwards the ratchet-toothed plug of the cock, and in successive upward motions of the piston the plug changes from one to the other of its two positions. According to the present invention, the gas-cock is fixed under the head of the piston, and the gas which is delivered into the piston makes its exit through the cock. The device which operates the plug is linked to, or secured to a weight resting on, the casing under the piston, so that as it rises under the increased pressure of gas the plug is rotated as the piston, and the gas-cock carried by it, moves upwards from the anchored operating device. In the illustration, the piston is in the lower and in the lifted positions.



Spark's Lamp Lighter and Extinguisher.

The piston A is arranged to rise and fall within the casing B in any convenient and gas-tight manner—for example, it may be provided with a bellows device or (as shown) with a mercury seal. Gas is admitted to the underside of the piston, whence it passes through a special form of cock D, when the latter is open, to a delivery tube E extending up into the burner above. The tube E forms an extension from the cock, and also guides the piston in its rise. The cock, which is operated by the rise of the piston, has affixed to it on the underside of the head a bracket A^1 (supporting the cock), provided with a dependent guide-rod G.

The cock comprises a hollow revoluble plug with a number of exit passages through the shell, spaced out equally around the plug. Three passages are shown, through any one of which gas may pass from the centre of the hollow plug into the delivery tube E. When none of the passages corresponds with the outlet, gas cannot pass out from the plug; and thus there are six positions of the plug, in three of which gas can pass, and in the other three gas cannot pass. These six positions correspond with the six teeth of a ratchet-toothed wheel L mounted on the end of the plug and engaged by a pawl M, operated by the rise of the piston in any suitable manner—either by a pull or a thrust—so that each time the piston rises, the ratchet wheel is revolved to the extent of one tooth. This cuts off the supply of gas and admits gas through the cock alternately.

The operation is as follows; An increased pressure being put upon the gas in the main, the piston A is lifted and the cock D is rotated to the extent of one-sixth of a turn. This changes the plug from the supply to the closed, or from the closed to the supply positions, as the case may be. If the pipe for the escape of surplus gas is not provided, the piston will descend when the extra pressure of gas is removed; and as it descends, the pawl rides idly, of course, over the ratchet teeth. The next time the piston is lifted by extra pressure, the cock is further rotated; and the change from closed to supply or from supply to closed takes place. The tube E may in some cases be used to limit the lift of the piston by meeting an abutment or stop in the bunsen tube, and in other cases adjustable studs or a circular flange may project from the top of the piston for the same purpose.

Carburettor for Air.

CARRUTHERS, F. J. C., of Dumfries.

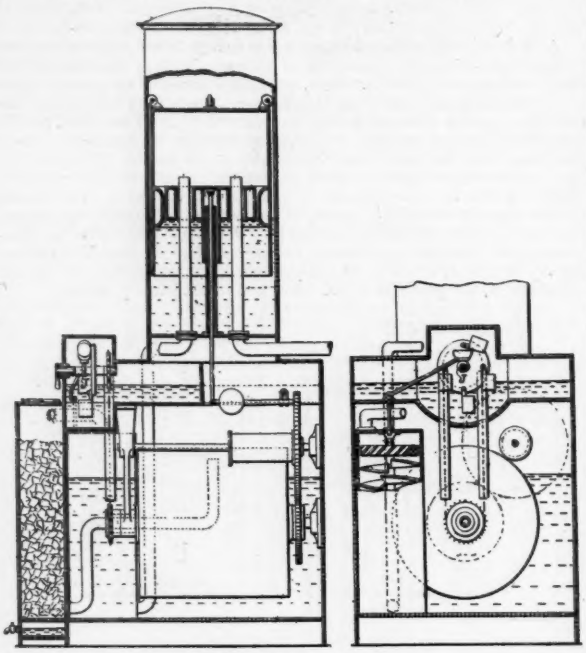
No. 13,145; June 20, 1908.

This apparatus (p. 392) comprises the usual elements of a water-operated pumping drum working through gear-wheels from a spindle having on it a weight-driven barrel. The drum delivers air by a pipe to a chamber filled with calcium chloride or other dehydrator; and thence the air passes by a pipe to a carburetting chamber, and so on to the gasholder, from which it is delivered for use.

The carburettor consists of a series of discs bent into helicoid form and strung, with distance-pieces between them, upon a cylindrical spindle, passing up through the carburetting chamber, fitting moderately closely the discs. Above the top disc is a small fan-like impeller, so arranged that the flow of air caused by the pump will, by acting on it, cause the spindle, with its discs, to rotate.

Carburetting liquid is fed to the carburettor by the following means: Within the tank is a spindle carrying a sprocket-wheel and a disc upon

which are pivoted a series of buckets. The sprocket-wheel is driven from another wheel upon the pumping-drum spindle by a chain passing through tubes fixed in the bottom of the petrol tank and extending above the level of the petrol. The buckets, upon "counter-clockwise" rotation of the disc, deliver the petrol they contain to a scoop connected by a pipe swivelling in a joint with a pipe delivering the petrol through a cage in which is formed the upper bearing of the spindle of the impeller, whence it trickles over the successive discs to be vaporized and taken up by the downwardly-passing current of air.



Carruthers' Carburettor.

Means for regulating the amount of petrol delivered by each bucket consist of an eccentric, upon which rests a scoop, the position of which may be varied by rotating the eccentric. When the eccentric and scoop are in the uppermost position, the buckets are so much tilted as to discharge the whole of their contents; but as the scoop is lowered, the buckets discharge only a part of the liquid. In order to provide for this adjustment, there is an eccentric upon a sleeve extending out through the side of the apparatus and provided with a handle by which it may be turned.

The bell of the holder is provided with an internal displacement chamber, of annular form and at normal water level, so that the movements of the bell are much augmented in their effect upon that level. The movement of the pump-drum is controlled, in accordance with the water level in the holder, by means of a float operatively connected by a link to a weighted lever so pivoted upon a stud that upon the bell rising, and the water level consequently falling, the end of the lever is pressed against the driving wheel and acts as a brake—the braking effect being relieved as the bell falls and the water level (and, consequently, the float) rises.

APPLICATIONS FOR LETTERS PATENT.

1792.—Cambridge Scientific Instrument Co., Ltd., "Pressure-gauges." A communication from H. W. Maurer. Jan. 25.

1835.—Cluderay, E. S., "Indicating audibly and visibly the expiration of certain intervals in the manufacture of water or producer gas." Jan. 26.

1869.—Stubbs, H., "Inverted burners." Jan. 26.

1883.—Pilgrim, R. & S., "Gas-generators." Jan. 26.

1890.—Glasgow, A. G., "Manufacture of water gas." Jan. 26.

1914.—Metropolitan Gas Meters, Ltd., and Forster, J. D., "Prepayment meters." Jan. 26.

1937.—Dempster, R., and Sons, Ltd., and Brooke, R. M., "Gas-retorts." Jan. 27.

2005.—Aird, K., "Gas cooking-stoves." Jan. 27.

2089.—Maslin, J., "Cleaning water-mains." Jan. 28.

2113.—Davis, G. K., "Gas-washers." Jan. 28.

2118.—Daly, J. R., "Automatic oiling devices for use in connection with gas-meters." Jan. 28.

2125.—Wiskott, M., jun., "Obtaining uniform radiation of light." Jan. 28.

2136.—Raigov, H., "Incandescent gas-lamps." Jan. 29.

2188.—Henss, E., "Retorts and the like." Jan. 29.

2197.—Davy, W. J., and Bateman, M., "Incandescent gas-lamps." Jan. 29.

2199.—Zechnall, L., "Incandescent burners." Jan. 29.

2214.—Jeffreys, C., "Preventing robberies from automatic gas-meters." Jan. 29.

2233.—Ewart, J. W., "Gas-regulating valves." Jan. 30.

2235.—Hoddle, C., and Thorn and Hoddle Acetylene Co., Ltd., "Bye-pass gas-cock." Jan. 30.

2260.—Condie, W., "Gas-lamps." Jan. 30.

2292.—Blau, H., "Producing liquid illuminating gas." Jan 30.

The Bland Light Syndicate have declared an interim dividend of 10 per cent.

LEGAL INTELLIGENCE.

ALLEGED TRESPASS BY A GAS COMPANY.

In the King's Bench Division of the High Court of Justice, last Friday, Mr. Justice Ridley and a Special Jury had before them an action in which a Mr. Cato and his wife claimed damages from the Ventnor Gas and Water Company and their Solicitor (Mr. Drew) for alleged trespass under the following circumstances: The plaintiffs were occupiers of a large house, called Highport Towers, standing in five or six acres of ground, at Ventnor. The house was fitted with gas-pipes; but they were not connected to the main, and there were no fittings. On Mr. Cato's application, the Company gave an estimate for completing the lighting arrangements, and did the work; but when the account was sent in, some dispute arose about it. On Nov. 22, 1907, Mr. Cato paid a certain portion, in respect of the water and coke supplied; but the balance remained outstanding. On Jan. 13, 1908, Mr. Drew, on behalf of the Company, wrote demanding £41 10s. 11d., and saying proceedings would be taken unless the amount was paid immediately. That day Mr. Cato had left Ventnor for London, on business, and subsequently went to Paris; but the letter was opened by Mrs. Cato, who wrote saying her husband was away, referred to the difference about the account, and asked when it would be convenient for her to call and discuss the matter. No reply was sent to her letter; but on the 16th of January a writ was issued, and a clerk of Mr. Drew's went to the house intending to serve it. Not finding Mr. Cato at home, he said the object of his visit was to collect the outstanding amount, and did not mention the writ. Mr. Cato paid a short visit to the house, and did not return till the 6th of March. In the meantime, Mr. Drew obtained an order for substituted service, and on the 17th of February the sheriff took possession, and remained for seven weeks. This was the alleged trespass. Interpleader proceedings were next commenced; but Mr. Cato having returned in the meantime, his Solicitor took out a summons to set aside the service of the writ and the subsequent proceedings on the ground that they were irregular, and that the affidavits of the defendants did not fully and fairly state the facts. The District Registrar refused to make any order; but on appeal to Mr. Justice Coleridge, in Chambers, he set aside all the proceedings subsequent to the issue of the writ. The Appeal Court affirmed the order, on an undertaking being given by Mr. Cato to enter an appearance, and gave him leave to defend. Mr. Norman Craig, who appeared for the plaintiffs, submitted that these orders rendered all the previous action illegal; that taking possession was a trespass; and as the effect had been to injure, and in fact to utterly ruin, the plaintiffs' credit, and compel them to leave Ventnor, they were entitled to very substantial damages.

Mr. A. Powell, K.C., who appeared with Mr. Mackenzie for the defendants, submitted, on the other hand, that the proceedings were not irregular, except on one purely technical point, and that the judgment of the Court of Appeal clearly indicated that their intention was only to give Mr. Cato an opportunity of defending the action if he desired. Of this he did not avail himself; and ultimately he paid the defendants' claim. He argued that the whole of the proceedings were in accordance with the ordinary practice, and that there was no cause of action and nothing to go to the Jury, unless his friend was prepared to prove some fraudulent concealment on the part of the defendant Drew or his clerk.

Mr. Norman Craig said he could only prove what he had pleaded in reply—that the facts had not been fully and fairly stated. If his Lordship held that this was not sufficient, it was not worth while to call the evidence.

Justice Ridley said he could not hold that it was necessary to set out in the affidavit the letters which were alluded to in the pleadings, as they had no reference to the service of the writ—the only matter to which the affidavit was addressed. He held that there was no cause of action shown; and he directed the Jury to find a verdict for the defendants.

This was done; and the action was therefore dismissed, with costs.

Sales of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards placed some issues of capital, by order of Directors. Ordinary £10 shares in the Alliance and Dublin Consumers' Gas Company, ranking for a standard dividend of 7 per cent., subject to the sliding-scale (this rate having been paid on similar shares for the past two half years), fetched from £12 2s. 6d. to £12 5s. each. New issues of 4 per cent. perpetual debenture stock and new ordinary stock of the Great Yarmouth Water Company realized £105 to £105 10s. and £96 to £98 per £100 respectively. On the same occasion, a few original £5 shares in the Bognor Gas Company, carrying 11½ per cent. dividend, fetched £12 7s. 6d. to £12 12s. 6d. apiece; and some additional shares, of the same nominal value, carrying 8½ per cent. dividend, £8 10s. each. A small parcel of £5 "A" shares in the St. Margaret's Gas Company, Limited, were put up for sale under instructions of an Executor, and sold for £6 7s. 6d. each, *cum div.*, which has for some time been at the rate of 6 per cent. per annum, from July 1 last. At a recent sale, Messrs. G. B. Hilliard and Son disposed of some £25 original shares in the Chelmsford Gas Company at from £52 to £53 each; and some additional shares, of the same nominal value, at £34 and £34 10s. per share.

Fakenham Water Bill.—The "Norfolk News" states that when the Agents to the Fakenham Water Bill were called upon by the Examiners to give proofs of compliance with the Standing Orders, there was no response; and the official list was marked "No appearance." It is understood that the Bill will not be proceeded with in the forthcoming session. Its object was to incorporate a Company with powers to supply water to the parishes of Fakenham, Hempton, and Sculthorpe, in Norfolk.

THE GASLIGHT AND COKE COMPANY.

Proceedings at the Half-Yearly General Meeting.

The One Hundred and Ninety-Fourth Half-Yearly Ordinary General Meeting of the proprietors of this Company was held last Friday, at the Chief Office, Horseferry Road, Westminster, S.W.—Mr. CORBET WOODALL, M.Inst.C.E. (the Governor), in the chair.

The SECRETARY (Mr. H. Rayner) read the notice convening the meeting; and the seal of the Company having been affixed to the register of proprietors, the report and accounts, which have already appeared in the "JOURNAL," were taken as read.

The Governor's Speech.

The GOVERNOR: I have now pleasure in moving that the report and statement of accounts be received and adopted. Taken as a whole, I think they will be regarded as satisfactory. I will direct your attention, first, to the capital account. It will be seen that we have spent in the half year £83,003, of which, as usual with this Company, much the larger part (over £70,000) is represented by works of distribution. Against this expenditure, we have to set £46,381 written off for depreciation; so that the net addition to the capital is £36,622. Upon the whole year, the depreciations, *plus* contributions to the redemption fund and £15,000 for land sold, equal the expenditure; so that the balance of capital account will be exactly the same at the end as at the opening of the year.

RECONSTRUCTION WORK AT FULHAM.

The reconstructed works at Fulham are now practically completed. The retort-house, fitted with electrically-driven machinery on the Fiddes-Aldridge system, is at work; while the re-housed and greatly improved carburetted water-gas plant will be making gas within a few days of this meeting. The effect of these reconstructions will be to add to the available capacity of the Fulham station, and to reduce to smaller dimensions the supply of gas from Beckton. In times of heavy demand, such as we met last week, a large proportion of the gas used in the western districts travelled 12 miles from Beckton, along almost the whole of which distance a heavy local demand had to be satisfied. To ensure an efficient supply at Fulham, the pressure at the starting point was exceptionally heavy, even with the very large mains employed. To introduce a larger quantity of gas into the mains at Fulham will greatly facilitate the service. The actual extensions of plant have been chiefly in the direction of improved appliances for handling and storing coke.

THE REVENUE ACCOUNT.

In considering the revenue account, it has to be borne in mind that the charge for gas was less than in the corresponding half year. At the commencement of 1908, the price was reduced from 2s. 11d. to 2s. 10d. per 1000 cubic feet, and, because of this, our revenue for the half year has been brought down by £40,000. There has also been a falling off in the prices realized for bye-products. This was anticipated. In August last, I told you that contracts for coal and oil had been made at prices showing a reduction from the preceding year's figures. But I went on to say: "It is improbable that the Company will obtain such good prices for their bye-products as they have been doing during the past six months; and the net saving may, consequently, be small." The accounts show that, while we spent £30,363 less on coal and oil, our income from coke and other residuals fell away by £43,557; so that the net cost of coal was greater by £13,194. My fear of six months ago has been more than realized. These are two heavy items to the debit of our account; but, speaking broadly, they are the only ones. The more important, that of the reduced rental for gas, was the expression of our policy of considering the interests of the consumers as fully and as quickly as we are able; and the second, the price of residuals, was, except to a small degree, beyond our control. The rest of the items in the revenue account are favourable. The rents of meters, stoves, and fittings show a total gain of £21,000—meter-rents are more, because, in the Christmas half of 1907, we collected them for only one quarter, whereas in this, we have received them throughout. The stoves and fittings are more, by reason of the great increase in the numbers issued. The figures under this head are most encouraging. All the manufacturing charges, salaries, wages, purification, and maintenance, show reductions; the total being £27,000. Distribution expenses are heavier by £17,000; but this is not more than the growth of the work of the department justifies. Avoiding wearying you with details which can be clearly understood from the printed accounts, I may say that the total cost—that is, the expenditure less the credit for residuals—is in excess, compared with the same period last year, by £6700 only, on a total of over a million sterling, which is a remarkably close approximation.

RENEWALS AND MAINTENANCE—CARBONIZING PROSPECTS.

It will have been noticed that we have spent less on renewals and maintenance of works by £13,000. There is still plenty of profitable work to be done in the re-construction of works and plant—work which can only be carried out at the cost of revenue. With this fully in mind, we are holding our hands for a little while, till we have before us the results of experiments which we are making in carbonizing plant—experiments which may affect radically the construction work of the future. It is probable that after the current year this item of wear and tear (manufacturing) may again be increased. The profit for the half year, after providing for preference charges, interest on debenture stock, &c., and a contribution of £10,000 to the redemption fund, is £354,687. Adding the balance brought forward (£412,298), we have £766,985 at our disposal. The Directors recommend a dividend at the rate of £4 10s. 8d. per cent. per annum out of this sum; leaving to be carried forward £423,324, or £73,773 more than at this time last year. With these figures before us, we have been able to realize my "confident expectation," expressed here six months ago, and we have further reduced the price of gas. This reduction is the third within five years, representing a gain to the consumers of £260,000; or, allowing £60,000 for the meter-rents re-imposed in 1907, a net gain of £200,000 per annum. I will not deal now with the Bill we are promoting in the coming session of Parliament, as we shall consider that later. I may mention that we have purchased a considerable proportion of the coal we shall require in the year commencing with July next at prices materially lower than those of the current contracts. We have also been able to buy oil forward at lower rates. We miss to-day for the first time for many years the presence of our valued Distributing Engineer, Mr. Foulger. He has been through a period of great pain and danger, and has only now emerged from it after losing one of his legs. His courage is as high as ever; and we hope to see him about again shortly. In the meantime, his work is being efficiently carried on by his Chief Assistant, Mr. H. S. Reeson, with the cordial help of the rest of his staff.

POPULARIZING GAS.

In the Chief Inspector's department, there is unceasing activity; and I think it safe to say that the most strenuous efforts of the staff are directed to ensuring economy of consumption for the consumers. We believe that the volume of our business can, in the long run, best be maintained and increased if the gas that we sell is used in the most efficient and economical manner. Wasteful and extravagant gas apparatus is no true friend to a gas company. As an example of the work done, we employ a considerable staff of lady demonstrators to teach the housewife (or cook) in her own kitchen how to manipulate the gas cooking-stove so as to secure the most satisfactory results. So far, such instruction has been given in over 15,000 kitchens; and we have reason to believe that we have thereby created or improved friendly relations between ourselves and those 15,000 customers who have had practical proof of our desire to give them good value for their money. We employ an expert to advise users of gas for power how to get the best results from their engines. We have a large staff of men employed on the maintenance of incandescent burners, so as to secure the best light with the least consumption, and a growing staff of specially trained fitters employed in overhauling and adjusting gas-fires. The steadily increasing use of gas-fires is a source of much satisfaction. The number of additional gas-heaters supplied by us during the past half year (9751) was 1433 in excess of the figures for the corresponding half of 1907, in spite of the exceeding mildness of the past autumn and the early part of this winter. The prospects of a steady increase in the sale of gas in the Company's district may be declared to be good; and constant vigilance and enterprise on the part of our outdoor staff is exercised to ensure it.

STAFF TRAINING.

The system of technical training and instruction instituted by the Board for the benefit of the distributing staff, the fitters, and the men employed in maintenance work, has been actively prosecuted throughout the past year, and is bearing fruit. The applications of gas to lighting, heating, and industrial uses daily grow in number and complexity; so that a sound grounding in the scientific and technical principles, as well as in the practical handling of these appliances, is necessary to men who come in contact with the public who use them. Such instruction, as I remarked when the system was started, cannot be obtained outside the Company. We are also making headway with the scheme for the admission of apprentices in this branch, in co-operation with the Education Committee of the London County Council, which we hope will not only bring us some useful recruits, but draw public attention to the career offered by the gas industry to clever lads of decent education. Hitherto, an undue proportion of such young fellows has been drawn to the camp of our friend the enemy; so that electrical engineering cannot find profitable occupation for all who would follow it. In respect of a career, I think the gas industry is at least as attractive.

THE PROFIT-SHARING SCHEME.

Passing from accounts and the details of the Company's routine operations, I have to explain a step recently taken by the Directors, which is of deep interest and importance. We have adopted a system of profit-sharing with the employees, which will make them all co-partners in the undertaking. It is unnecessary now to defend the principle of co-partnership, or to discuss the prospects of success of a good and well-thought-out scheme of the kind (such as ours) in connection with a gas company. The institution of co-partnership is now a plain business proposition; and as such we have embraced it for the benefit of all concerned. I need hardly remind you that the application of the system to gas companies was first advocated by the late Sir George Livesey (whose death we all so deeply deplore); and that he made the South Metropolitan Company a striking example of its usefulness to employees and the Company.* When we look round, and mark the ferment of the minds of men in the Socialist and Labour camps, producing symptoms such as the resolution recently passed at the Portsmouth conference for "the socialization of the means of production, distribution, and exchange, and the complete emancipation of labour from the dominion of capitalism and landlordism," we must feel that mere passive resistance—a standing upon the old ways, with perhaps police protection in reserve—is not adequate to the reuniting of social forces and classes so frankly set in opposition. Something positive is required to prove that the last word has not been said for the social system which has served the country until now. In this and similar industrial undertakings, there are required, for efficiency, capital and labour, skill and enterprise. In practice, the relation of employer and employed cuts through every industrial organization; and this division has been allowed to go so deep, and has become so wide, that the tie of a common interest, though it is unquestionably there, is invisible to some. A plain, though strong, bond of union is wanted to bind our forces together more firmly even than before, since the disintegrating influences are more active and insidious; and we believe that we

* At the door of the meeting-room were copies of a circular which had been distributed among the men, explaining the details of the plan.

have found it. This Company has never displaced hand labour by machinery for the sake of change, or to follow a fashion; but we have effected great economies, and we hope to make more. We hope it because an industry like ours cannot stand still. If it does not advance it will decay. We see possible openings for the application of our product, especially as fuel, to many arts and industries; but they are applications only possible with gas at a low price. We have no desire to reduce the number of workers—very much the contrary; but the way to avoid this and to make room for a larger number is to cheapen production and increase the output. The plan we have adopted will help in this direction. Instead of reduced prices being reached at the expense of labour, there can in future be no gain to consumers or investors which is not accompanied by a gain to the workers. For the first time, the interests of the three are made identical. One word more. We are asking, and we expect, that each employee will do his best, and that he will be content with nothing short of it. That is the precept; and we are now enforcing it by example. We have done in the past what we could to make service with the Gaslight and Coke Company something to be desired. Our rates of pay have been well up to the standard; our pension scheme is a generous one; and we do all we can to make the conditions of service healthy and pleasant. We do not, however, wish to stand upon a good record. This scheme promises a better prospect, an improved status, for the men; and we have offered it in the assurance that our motives will be understood, and that the results will be satisfactory all round. The resolution that I put to you is: "That this meeting do agree with and confirm the report of the Directors and the Auditors' report and statement of the accounts of the Company as transmitted to the proprietors on the 25th ult."

The Deputy-Governor (Mr. Howard Charles Ward) seconded the motion.

Mr. A. M. Paddon said he did not think that in the history of the undertaking any two more important propositions had been submitted to the proprietors than those contained in the report of the Directors; and, of the two, the more important was the one to which the Governor had called attention—that was, the question of profit-sharing with their employees. He supposed that everybody, whether proprietor, director, or any other person, however remotely connected with the gas industry, must sympathize with the objectives of the scheme, which were, he took it, to improve the condition of the workman, to identify his interest with that of his employer, and to protect the employer from the possibly militant action of the Trades Unions. He did not wish for one moment to blink at the last one, because most of them knew that when the first profit-sharing scheme (that of the South Metropolitan Gas Company) was propounded, it precipitated a conflict with Trade Unionism which was fought out to the bitter end, and was successfully won by the brilliant abilities of Sir George Livesey, and by nothing else. Such a conflict as that had never before occurred in the gas world; and he hoped such another would never occur again. But, in any scheme that went so far as this, there must be a certain element of danger, even although one tried hard to consider and to combat it. It would be a very invidious thing to oppose the principle of profit-sharing—at least, unless one had an alternative as promising in its benefit to the workers. He thought that the present scheme did not cover the ground so completely as it might be made to do. It involved the proprietors in certain dangers. The first objection that might be taken was that if the scheme was carried out to its ultimate conclusion, even with every element of success which its promoters hoped for, the effect would be very microscopic in the way of benefit to the workers. Of course, it took a certain amount of principal; and when one took the interest that would accrue from the investment of that capital, it would be a very small amount with which to meet the exigencies of the work and the dangers to the workman's life. He asked, What were these dangers? The danger of being left in need in old age, or of falling sick. The scheme must absorb a large amount of money; and, with great experience of gas working, he thought that if the money which would be devoted to the scheme could have been devoted to augmenting the income of a man on retirement or on sick pay, it would have done something very real in place of something which was rather unsubstantial in the best of circumstances. He thought the Government had done a wise thing in starting old-age pensions, although he considered the scheme must be amended so as to exclude those who had invested money. Therefore, it would be impracticable to wedge a scheme of profit-sharing into the Government scheme of old-age pensions. Had the resources of the Company been dedicated to providing for old age, and to shortening the period of qualification for the pension, a greater benefit would have been assured to many than under the present scheme. He thought there was a danger which might arise under clause 75 of the Companies Clauses Consolidation Act, 1845, which gave a special scale of voting power to those holding stock in the Company, if they were to be sharers in the undertaking. A very vast voting power would be transferred to the workers of the Company in a degree out of all proportion to their investment. This was a real danger; and, if nothing else brought it home to them, he would refer to the words quoted by the Governor when alluding to the Socialistic Conference—words that breathed hatred and revenge against the very interest which the Directors had to protect. He could not help saying that a very large power was being transferred to those whose interests were not precisely identical with the interests of the proprietors. The wage-earner's first desire was to get as much money as he could; and he would not be deterred from doing that by the infinitesimally small sum which he would get under the proposed scheme. Everyone tried to get as much as he could; and, therefore, one could not blame the worker for doing so.

Mr. W. A. Hounsom said he had listened to the interesting speech which had fallen from the last speaker; but he wished to say, in a very few words, that, personally, he supported this scheme of co-partnership. He congratulated the Company on the position they had attained, and which enabled them to contemplate such a scheme, because it spoke volumes for what had happened during the past few years. He did not fancy that he and Mr. Paddon were very much in accord in one respect. He did not look askance at anything so novel as co-partnership. On the other hand, after careful consideration, the Board had come to the conclusion that it was quite the right thing to do. They had already successfully brought together the customers and the Company by the sliding-scale, and this scheme would act in bringing the Company and its employees together. It was not such a scheme as they would have contemplated in years gone by, when there was something in the goodwill of a business, and when the tradesman and his customers were in accord, because then they had small companies. Now they had a tremendous organization. They could not fight with the ordinary conditions of trade which had come about during the last generation; and they had to accept the altered conditions, and to adapt themselves to the methods of to-day to meet them. He thought the system of co-partnership was the application of the sliding-scale, and was adapting the trade of to-day to the altered conditions. For this reason, apart from anything else, he should support the resolution. But, further than this, he believed that on sound moral principles the scheme was a good one. His friend had spoken of the microscopical advantages to the workman, and so forth. After all, they were all dependent upon very small things; but it was the very small things which, in the aggregate, produced great results. There was one other reason for supporting the resolution, and that was that it was such a tribute to their departed friend Sir George Livesey. He trusted that none of the possible dangers which had been referred to would arise; and he looked forward to the time when there would be an inauguration of good-will and interest in connection with this tremendous organization; and that they would look back with gratitude to those who had the courage of their convictions in bringing forward such a scheme.

Mr. J. Burton thought the proprietors would have been much better able to discuss the scheme if they had had details of it before them.

Mr. R. J. N. Neville said the proposition brought forward by the Directors was one of very great moment, and one which the shareholders ought cordially to support. The Governor struck what he believed to be the key-note of the whole position when he stated that this was a business proposition; and though they had heard that there were possible chances of individuals getting an infinitesimal gain, the question was not the amount of the gain but one of principle—namely, whether by combining the two interests—the interests of the master and the men—they were doing that which was most calculated to get the best results for the advantage of both parties. It was not a question of charity, but of a bargain between those who had work to give and those who wanted to do the work. Being an ordinary business proposition, he thought the proprietors should support the Board in carrying out what must eventually lead to efficiency. For a business to be successful, the proprietor must run it in such a way as to get the maximum amount of efficiency. It was true they had not Sir George Livesey with them; but there were other men who would follow him in the gas industry, and deserve as well of it as he had done. But, putting all this aside, there was no doubt Sir George had set them a great example; and they now had the opportunity of following it. It was not a question of any person's individual superiority, but one of principle; and if Sir George Livesey was right in laying before the gas industry a right principle, it was only right they should follow it. It seemed like drawing a red-herring across the track to say that they should not adopt the scheme because Sir George was not with them. They should not be deterred by any such reason, but should rather say: "As Sir George has shown us the way, we will do our best to follow it."

Mr. James Newman, who said he was interested in the South Metropolitan Gas Company, spoke of the wonderful success which had resulted from the adoption of the co-partnership scheme in that Company, and also in the firm of Clark, Nichols, Coombe, and Co., where the dividend had risen in twelve years from 5 to 20 per cent. The effect of adopting the scheme would be to make the men more careful in their work.

Mr. A. H. Bailey said he trusted that, as the price of gas had been reduced, the shareholders would, under the sliding-scale, receive an increased dividend.

Mr. Thos. Eddison expressed his implicit confidence that the Board would do their best in the interests of the Company. He said that in the capital account there was a credit for £46,380; but he could not find in the accounts any record of where the credit came from. If it was a *bonâ fide* credit, it should presumably have been taken from the revenue account. Then, again, turning to that account, the first item was "Coal into store (see Account No. 11);" and when he turned to No. 11, he saw five items of coal: "In store June 30, 1908," "Received," "Carbonized," "Used," and "In store Dec. 31, 1908." If the coal went into store, that system would appear to be incorrect and unsound. If, on the other hand, the money value was represented by the two items "Carbonized" and "Used," the term "Into store" would appear to be a wrong one. It should be "Coal carbonized and used." He should like to know exactly what was meant by the words "Coal into store."

The Governor: With regard to the expression "Coal into store," what is meant is the coal used *plus* all charges upon it. In account No. 11, it is coal "in store," not "into store."

Mr. Eddison suggested that instead of using the term "Coal into store," they should say "Coal used."

The Governor's Reply.

The Governor: That shall be considered. The credit to capital of £46,000 is on account of depreciation, and, excepting £566 for land sold, the whole has been brought back from the revenue account, where it is included in the items repair and maintenance of works and repair and renewal of meters and of stoves respectively. With regard to an increase of dividend because of the last reduction in price, this will depend upon the state of our accounts at the end of the half year. I am puzzled by the observations of the first speaker, and shall not attempt to follow him on some of the lines he felt it right to take. He claims to be in complete sympathy with the objective of the Directors in introducing the scheme of co-partnership, and proceeds to make it, so far as his ability allows, unacceptable to the workers whom it is intended to benefit. He spoke of the microscopical benefit which would come to the employees, and at the same time warned us of the

danger to be feared from the "very vast voting power" which would be transferred to them by reason of the operation of the scheme. As no shareholder has a vote until he has invested £250, the arrangement belittled will have achieved a success beyond our utmost hopes when the men's voting power attains any real weight or importance. For myself, I shall rejoice exceedingly when it does. I should like the shareholders to read the letters we have had from every station and department spontaneously written by the men after they had intelligently considered the proposal, expressing a deep sense of obligation to the Company for having met them in this way, and pledging themselves in the most cordial and hearty manner to make the scheme a success and save its becoming a cost to the Company. Approval has been expressed of the Government plan of pensions; and with this I am in hearty agreement. But the fact is ignored that the Company have a pension scheme of their own, which comes into operation, not at 70 years of age, but at 60, and is on a far more liberal scale than the Government could possibly offer to the nation at large. The shareholders may rest assured that, whether in sickness or in old age, the employees of this Company lack no care or help which the Directors are able to afford them.

The resolution was then put and carried unanimously.

The Dividend.

The Governor: I have now to propose: "That the sum of £10,000 be set aside, out of the divisible profits of the Company for the half year ending on the 31st of December last, towards the redemption fund, in accordance with the provisions of the Company's Act of 1903; and that a dividend for such half year be declared—on the 4 per cent. consolidated preference stock at the rate of £4 per cent. per annum; on the convertible 5 per cent. preference stock at the rate of £5 per cent. per annum; on the 3½ per cent. maximum stock at the rate of £3 10s. per cent. per annum; and on the ordinary stock at the rate of £4 10s. 8d. per cent. per annum, subject to the deduction of income-tax."

The Deputy-Governor seconded the motion; and it was carried unanimously.

Re-Election of Directors and Auditors.

Mr. Ulick J. Burke: Ladies and gentlemen, it is my duty and my pleasure to propose the re-election of the Governor of the Company, Mr. Corbet Woodall. Three years ago I had the pleasure of proposing his re-election; and I may say that this statement, and the others that you have had, amply justify what I said then and his re-election. I should like to add this—that the records which we have had do not tell the whole story. We on this side of the table—his colleagues—and the officers and staff of the Company know the whole-hearted devotion which Mr. Corbet Woodall gives freely to the interests of this great Company. That whole-hearted devotion requires the display of a considerable amount of energy and the expenditure of time; and we know what time is worth to our Governor. I propose his re-election.

The Deputy-Governor: And I have the greatest pleasure in seconding the motion.

The resolution having been carried unanimously,

The Governor: Ladies and gentlemen, I am much obliged to you for this expression of your confidence. I now beg to propose that Mr. Ward be re-elected a Director of the Company. Mr. Ward has been with us for very many years, and has never slacked in his interest in the prosperity of the Company.

The resolution was seconded by Mr. W. A. Hounsom, and carried unanimously.

Mr. Ward briefly acknowledged his re-election.

On the proposition of the Governor, seconded by Mr. Hounsom, Mr. J. D. Walker, K.C., was re-elected a Director.

The retiring Auditors (Mr. J. Allen Stoneham and Mr. J. J. Walker) were unanimously re-elected.

Concluding Resolution.

A resolution authorizing the sale of certain portions of the Company's property not now required for the purposes of the undertaking, was also unanimously carried.

The Governor: That completes the business of the ordinary meeting.

Extraordinary Meeting.

An Extraordinary General Meeting was then held to consider the Bill promoted by the Company for next session.

The Secretary read the notice convening the meeting, and also the heads of the proposed Bill.

The Governor: There are a great number of clauses in the Bill; but the items of interest are comparatively few. I hope it will not be difficult to satisfy you that the Bill we ask you to approve will, if passed, operate to the advantage of the Company. Its chief object is the absorption of the West Ham Gas Company. The district we are privileged to serve, enormous as is its extent, is essentially urban; and, except for a comparatively small area to the north of London, is closely built over. Years ago we had the right to extend our mains very far indeed. There was, I believe, once a dispute as to whether our rights extended to York or stopped short at a point nearer home. Gradually, however, we have been "cabined, cribbed, confined," so that we barely cross the border of the Metropolitan area. Suburban gas companies to the number of about twenty have been formed and have obtained statutory powers till they ring us round, and we are in some danger of being stifled. Great as has been the growth of London within recent years, its expansion has been largely into the suburbs, and therefore away from us. Not only is our area being rapidly filled up, but other causes tend to check the increase of our business within it. The development of electricity supply has taken away some of our lighting; and though we are holding our own, it is at a greater cost. Again, the introduction of the Welsbach mantle has, as I have mentioned before in this place, enabled gas consumers to reduce their consumption to one-fifth or one-sixth for the same amount of light. If it were not that the standard of light is much higher than formerly, this cause alone would lead to a shrinkage of our output of a very serious nature. We welcome everything that operates to reduce the cost of gas; but the effect is, for the time, to limit our sales. While, for the reasons named, our rate of progress is slow, we have been remodelling our plant, and introducing improvements which have largely added to the producing capacity of our works. Though we have discontinued the manufacture of gas at several stations, we have still a margin of plant much in excess of what is needed for safe working. This idle plant is at present earning nothing; and we are anxious to find it occupation. Added business, bringing this into use, will involve no capital charges except for distribution. The saving upon this item would be very considerable. Now, as we cannot at present look for this added volume of business within the field allotted to us, it seems reasonable we should try to break through the encircling ring into an open country in which there is more prospect of growth. With this object in view, we directed attention to the Suburban Gas Companies nearest to our eastern stations, Bromley and Beckton, where we have the largest surplus of plant. West Ham is the largest of these, and is in a position which gave our overtures peculiar weight. The Company is a prosperous one, with a large district and a rapidly growing demand for gas. Its output is approaching the limit which can be produced with safety and economy in the present works and on the site now occupied. In 1902 the Company purchased land upon which to erect new works, and upon it they constructed a large gasholder. Granted a continuance of the present rate of growth, manufacturing plant must be added to the gasholder, and complete works built. This will involve the spending of much capital, a large part of which will be unremunerative for a considerable time. We have, then, this situation: The West Ham Company have a business which will shortly call for larger works and more capital, while we have at our disposal surplus works far more than sufficient to meet the West Ham growth, and we are desiring occupation for them. It cannot be to the public interest, any more than to that of the Companies respectively, that capital should be duplicated and the price of gas thereby injuriously affected. It is on these grounds that we are going to ask, with your approval, that Parliament should authorize the absorption of the West Ham Gas Company into ours. Several other matters of importance are dealt with in the Bill. Clause 36, dealing with the testing of meters, is necessary in order to bring the practice of our Company into line with that of all other gas companies under recent legislation. We have had difficulties in some cases, where meters have been found to be working incorrectly, in determining what is a fair allowance, either on the part of the Company to the consumer, or by the consumer to the Company. Then with regard to illuminating power. The Gaslight and Coke Company is now the only one within the Metropolis or its immediate neighbourhood which is supplying gas of a quality of 16 candles. There is a consensus of opinion that a standard of 14 candles, which can be reached with gas made from Durham coals without enrichment from any other source, is better suited to modern requirements than the higher quality, which has to be enriched either with cannel or with oil or spirit. The probability is that the alteration in the standard will affect but very slightly the actual quality of the gas supplied to the public. I may mention that the standard of the West Ham Company was reduced in 1902 from 16 to 14 candles. Then there is a clause with regard to the amount of Directors' fees. It is proposed to increase the amount of these by £2000. They were last settled in 1883–26 years ago—and the circumstances of the Company are now very different from what they were then. I think it right to mention that the alteration now suggested is intended to provide fees for a Director proposed to be taken over from the West Ham Company, and that otherwise it affects personally the Governor only. Before moving the resolution with regard to the approval of the Bill, I must express the deep pain with which the Directors have heard of the death of Mr. John Clark, the Chief Engineer of the West Ham Gas Company. I went over the works of the Company on Tuesday of last week with our General Manager, and Mr. Clark was then in perfect health; and for three hours he was about the works with us. The following night he took a chill going home through the fog, and on Monday morning died. He was a most admirable servant to the Company, and brought a knowledge to bear upon his work which reflected great credit upon himself and was of great advantage to the Company. I now beg leave to move: "That the Bill now submitted, intituled 'A Bill to authorize the acquisition by the Gaslight and Coke Company of the undertaking of the West Ham Gas Company, to confer further powers on the Gaslight and Coke Company, and for other purposes,' be, and the same is, hereby approved, subject to such alterations as may be made in the Bill by Parliament and approved of by the Directors."

The Deputy-Governor seconded the motion.

Mr. A. M. Paddon congratulated the proprietors, and the Board especially, upon the excellent manner in which the Bill had been drafted. He hoped the Directors would stand firm on certain points, especially that the standard price to be charged for gas should be 3s. 3d. per 1000 cubic feet. Some years ago the standard was 3s. 9d., then it dropped to 3s. 4d., and now it was 3s. 3d.; and therefore he hoped the Directors would make it a *sine quâ non* of the Bill that the standard should not fall below 3s. 3d. In his opinion, the undertaking was to a very great degree more stable than it was a few years ago. There was one point which must not be forgotten, and this was that the use of the new burner which had been adopted by other companies would benefit the Company to the extent of about 3-candle power.

Mr. R. J. Neville asked whether the illuminating power of the gas was to be reduced to 14 candles, and if so whether they would be relegated to the same position on the south side of the Thames as they occupied in recent times. It had always been a great hindrance to the Company that they were dragged at the wheels of the South Metropolitan chariot. He should also like to know whether there was any provision in the Bill with regard to slot meters. At the present time there was great difficulty in knowing the exact position of the Company with regard to these meters where there had been a burglary; and he would suggest that some provision should be inserted in the Bill, so that the Company might get their own where they had been robbed. He also desired to know whether, in fixing the price at £118 for £100, the price of the different stocks had been taken into consideration.

Mr. A. F. Phillips said that, having carefully read the Bill, he had the greatest pleasure in supporting the resolution. If the Bill passed,

it would be not only a benefit to the proprietors of both Companies, but also to the people at West Ham.

The GOVERNOR: I have to acknowledge the more or less friendly criticisms which have been offered on the Bill. With regard to the standard price, one speaker alluded to the reduction from 3s. 9d., and advised us that we have now reached the irreducible minimum, and must not go farther. All I have to say is that the shareholders approved the reduction from 3s. 9d. to 3s. 4d.; and I can only ask you to believe that the Directors will exercise the utmost judgment and what ability they have in conducting the Bill, and maintaining the price that will give the best dividend to which we are entitled. With regard to prepayment meters, we have carefully considered the matter; but we felt that the difficulty of reconstructing the legislation with respect to responsibility was so great that we preferred to leave the law where it stands at present. I regret that a statement should be put forward here that can only be injurious to the Company, and go to make a case for those who may feel it to be their duty to oppose the Bill. Statements that are made should be as nearly accurate as possible. To say that the new burner which we have adopted, in common with the whole gas industry, gives to the Company an advantage of 3 candles, is nonsense, and contrary to the fact.

The motion was then put and carried unanimously.

The GOVERNOR: That completes our business, and I thank you for your attendance.

A hearty vote of thanks was accorded to the Governor and Directors, as well as to the chief officers and staff, for their able services in the Company's interests.

The GENERAL MANAGER (Mr. D. Milne Watson), in returning thanks, said a word from him might not come amiss with regard to the profit-sharing scheme. The Directors of the Company had always done great things for the employees; and when the proprietors realized that pensions, sick pay, accident pay, and other advantages, had been given, they would see that their record was an exceedingly good one. No case of sickness or injury went unheeded. If a man grew old, he had a pension; if injured, he was granted an allowance; and in time of sickness he received a certain amount. It had been said that it was only a small sum; but it would be found that it was a very large one —3 per cent. on the wages and salaries, which was a material gain to the workmen and officers. There were 10,000 men in the Company, and they said that what the Directors had done was a splendid thing. He felt sure the men would serve the Company even more faithfully in the future than they had done in the past.

The proceedings then closed.

BRENTFORD GAS COMPANY.

Half-Yearly Report and Accounts.

According to the report for the six months ending Dec. 31, which the Directors will present at the ordinary meeting on Friday, the business of this Company still continues to rapidly increase; the quantity of gas sold during the half year having been 5·66 per cent. in excess of that of the corresponding period of 1907, which itself showed an increase of 7 per cent. The largely augmented business has necessitated expenditure for improving the means of manufacturing and facilitating distribution, which, with a falling market for residuals and dear coal, has considerably reduced the profit for the period covered by the accounts. The Directors, however, wish to emphasize the fact that the improvements referred to are of a permanent nature, and will largely benefit future half years. The works and plant at both stations are in efficient order.

The accounts accompanying the report show that the revenue from the sale of gas amounted to £181,523; from meter and stove rents, to £19,961; and from the sale of residual products, to £36,686—rents and transfer fees making up a total of £238,203, compared with £228,948 in the corresponding period of 1907. On the other hand, the manufacture of gas cost £136,443; distribution, £48,506; management, £6900—the total expenditure being £208,475, against £178,323. The balance carried to the profit and loss account is £29,748, compared with £50,625 this time last year. The amount available for distribution is £86,423; and the Directors recommend the declaration of dividends at the rates of 5, 12½, and 9½ per cent. per annum on the preference, consolidated, and new stocks respectively.

The working statements show that 89,247 tons of Newcastle coal and 1,303,410 gallons of oil were used in the production of 1,444,628,000 cubic feet of gas, of which 1,312,178,000 cubic feet were sold and 1,333,228,000 cubic feet accounted for. The estimated production of residual products was: Coke, 55,795 tons; breeze, 6958 tons; tar, 1,045,039 gallons; ammoniacal liquor, 23,926 butts.

Cambridge Gas Company.

In the absence through indisposition of the Chairman, Mr. W. B. Redfern presided at the half-yearly meeting of the Cambridge University and Town Gas Company last week, and referring to the position of the undertaking and its general prosperity said that, taking each department, they found an advance in their work. The number of ordinary consumers had gone up something like 120; while the slot-meter consumers had increased by 174. This indicated a happy state of affairs. The report showed that the amount received from residuals had gone down very considerably. Owing to the general depression of trade, the sale of coke, tar, and other bye-products had been much smaller than usual. As trade improved, this matter would no doubt right itself; and in all probability they would be able to present a better report in this respect next year. In spite of this fact, and the reduction of 1d. per 1000 cubic feet in the price of gas compared with what it was the previous year, they showed a very healthy balance. Another matter he might mention was that their new premises were well in hand, and they would probably be able to take possession by July. The report was adopted, the dividend was declared, and the Board were thanked for their services.

YORK UNITED GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Thursday—Mr. JOHN R. HILL, J.P., in the chair.

The SECRETARY AND MANAGER (Mr. John H. Hill) having read the notice convening the meeting, the report of the Directors was presented. It showed that the balance carried to the profit and loss account was £8831, and that a sum of £8833 was available for distribution. The Directors recommended the payment of dividends at the rate of 4 per cent. per annum on the preference and consolidated ordinary stocks (less income-tax), amounting together to £7980; the transfer of £706 to the reserve fund; and the carrying forward of the surplus. The addition to the reserve fund would, it was stated, bring it up to £25,000, which was the maximum amount authorized by the Company's Acts in respect of the present paid-up capital. Compared with the latter half of the year 1907, there was an increase of more than 3 million cubic feet in the quantity of gas sold. During the half year covered by the accounts, 1470 yards of additional mains had been laid, 367 meters put in for new consumers, and 381 cookers, 214 gas-fires and boilers, and 2091 lights fixed.

The CHAIRMAN, in moving the adoption of the report, said that this and the accounts submitted showed a steady growth in the Company's business; and the figures of the revenue account compared favourably with those of the corresponding half of the previous year. The result was that, after providing for the usual dividends, the Directors were able to recommend a transfer to the reserve fund of £706 and to carry forward a small surplus. The stockholders would remember that a few years ago the Directors decided that, besides any transfers that could be made from the profit and loss account from time to time, the dividends received from the reserve fund investments should be placed to the credit of that fund, instead of being put to revenue, in order that the fund might be brought up to the maximum amount allowed under the Company's Acts. The Directors were able to congratulate the stockholders on the fact that the policy then adopted had resulted in the reserve fund now standing at £25,000, which was the maximum allowed in respect of the present paid-up capital of the Company. The whole amount was invested in first-securities, and formed a source of strength to the Company and a substantial security to stockholders.

The VICE-CHAIRMAN (Mr. James Melrose, J.P.) seconded the motion; and it was carried unanimously.

The dividends recommended having been declared,

Mr. J. CROSS moved a vote of thanks to the Chairman and Directors for the efficient manner in which they had conducted the Company's business. He expressed pleasure in reciprocating the congratulations of the Chairman on the prosperous condition of the undertaking.

Major LINDBERG seconded the motion, which was cordially adopted.

The CHAIRMAN having acknowledged the vote, a similar compliment was paid to the Secretary and officers.

Mr. HILL briefly replied, and the proceedings closed.

NEWPORT (MON.) GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held on Monday last week—Mr. R. LAYBOURNE, J.P., in the chair.

The SECRETARY (Mr. T. H. Hazell) having read the notice convening the meeting, the report of the Directors, which was accompanied by the accounts for the six months ending the 31st of December, was presented. The latter showed a balance of £10,069 available for distribution; and the Directors recommended the payment of the full statutory dividends. Appended to the Directors' report was one by the Engineer (Mr. T. Canning), in which he certified that the two stations of the Company were in efficient repair and satisfactory working order.

The CHAIRMAN, in moving the adoption of the report, said the capital expenditure during the half year had been increased. On new buildings, plant, machinery, &c., they had spent £2389; on new mains and service-pipes, £801; and on new meters, £874. This showed the progress the Company were making. Many of the new meters were penny-in-the-slot ones, which were a remunerative investment. On revenue account, the coal had cost £149 more than in the corresponding half of 1907; but against this they had an increase of £397 in the sales of gas. So that their position would be very favourable if it were not for the great loss they suffered on residuals. Their sales of coke amounted to £1187 less than in the second half of 1907, as a result of the drop in the price. But though the loss on residuals affected the profit and loss account, there was sufficient to pay the statutory dividend without having recourse to the reserve fund, which was satisfactory. The Thrift Society of the Company was making progress, but not to the extent the Directors would like to see it. The amount standing to its credit was £1154, as against £872 in the corresponding period of 1907, besides £1500 which the workmen had invested in the Company's stock. This was to a certain extent satisfactory; but it did not reach the amount the Directors had hoped to see. A great many working men did not save anything; and he was afraid that the old-age pensions would not be conducive to thrift among the working classes. It was satisfactory to the Company, however, to know that their employees were saving, if not to the extent they would like.

Dr. H. M. BREWER seconded the motion; and it was carried.

A dividend of 5 per cent. for the past six months, making 10 per cent. for the year, having been declared,

Alderman W. J. LLOYD proposed that the best thanks of the shareholders be given to the Chairman and Directors, for their satisfactory conduct of the Company, and also to the officials, for their very efficient services during the past year. He observed that they were especially indebted to Mr. Canning and Mr. Hazell for the thorough manner in which they studied the Company's interests.

Mr. J. HOLEHOUSE seconded the resolution.

Mr. T. SPITTLE asked what reply had been received to the Company's offer to the Corporation to exchange the open burners in the public lamps for incandescents, and on what terms the offer was made.

Mr. HAZELL explained that they had offered the Corporation to

convert the remaining flat-flame burners in the town into incandescent burners, and to do the work at something below cost price. The actual price of the materials used, without any charge for labour, would amount to, for something like 500 lamps, a payment equal to £12 12s. per quarter for three years. Up to the present, no reply had been received from the Corporation; but they were considering the question.

The motion having been unanimously carried,

Mr. HAZELL, in responding, expressed his indebtedness to the officials in his department. He observed that during the past six months there had been a substantial record in the fittings department of the Company. There had, in fact, been a most remarkable development of work in connection with the fixing of radiators and geysers for baths. Not only so, but they had had the satisfaction of putting incandescent lighting into private houses, in preference to electricity. All these things made for the welfare of the Company.

Mr. T. CANNING, in his response, remarked that all in his department worked with one will and one determination to promote the interests of the Company, as they rightly looked upon these as being their own interests. In regard to the Company's offer to the Corporation, he did not know whether the public of Newport conceived that the Corporation proposed to incur a very heavy burden, and place this burden on the ratepayers, by going in for a large loan to extend the electrical mains over their long stretch of 80 miles of streets and roads, when equally efficient work could be carried out by the Gas Company at the ridiculously small cost of £150 spread over three years, which was what their offer to the Corporation would mean. Personally, he had no doubt the Corporation would eventually have to accept the Company's offer, especially when the public realized that the work could be so cheaply and effectively done by them.

The proceedings then closed.

ARBITRATION IN INDUSTRIAL DISPUTES.

Board of Trade Regulations.

Readers of the "JOURNAL" are doubtless aware that a scheme has lately been devised by the President of the Board of Trade (the Right Hon. Winston Spencer Churchill) for the appointment of Courts of Arbitration for the settlement of industrial disputes. When both parties to a dispute desire to have their differences settled by arbitration, it is open to them jointly to apply to the Board under the Conciliation Act either (1) for the appointment of a single Arbitrator or (2) for the appointment of a Court of Arbitration in accordance with the scheme. The following regulations have been drawn up by the Board in connection with the appointment of the Courts.

1.—The application should state: (*a*) The subject-matter of the dispute; (*b*) whether the parties wish the Court to consist of a Chairman and two Arbitrators or a Chairman and four Arbitrators; (*c*) whether the parties desire the Board (1) to appoint a Chairman and Arbitrators, all of whose names have been jointly selected by the parties from the respective panels, or (2) a Chairman whose name has been jointly selected by the parties from the Chairmen's panel, and to select and appoint the Arbitrators from the respective panels, or (3) to select and appoint the Chairman from the Chairmen's panel, and to appoint Arbitrators jointly selected by the parties from the respective panels, or (4) to select and appoint all the members of the Court from the respective panels; (*d*) whether the parties wish the Court to appoint, or apply to the Board to appoint, a Technical Assessor or Assessors.

2.—A Court of Arbitration shall, if either party or both parties shall have so requested, or may on their own initiative, if they consider that the Assistance of a Technical Assessor or Assessors is expedient, appoint, or apply to the Board to appoint, a Technical Assessor or Assessors accordingly.

3.—Technical Assessors shall not be members of the Court. They will be appointed solely for giving the Court information on technical matters when required by them. They will only be entitled to be present at such stages of the proceedings as the Court may direct. Every Assessor before taking up his duties shall pledge himself in writing to keep secret all matters with which he shall in the course of the performance of such duties become acquainted.

4.—All procedure in connection with the hearing of a case shall be settled by the Chairman after consultation with other members of the Court, including the mode of appearance thereat.

5.—For the convenience of the Court, each application should be accompanied by a statement showing (*a*) whom the parties desire to represent them at the hearing (whether counsel, solicitor, secretary of the association, or trade union involved, &c.), and (*b*) the approximate number of witnesses each side desires to call.

6.—The award of a majority of the members of the Court shall be the award of the Court. When no majority can be obtained in favour of an award, owing to the Arbitrators being equally divided, then the matter shall be decided by the Chairman, acting with the full powers of an umpire.

7.—After an award is made, it shall be signed by the Chairman on behalf of the Court, and he shall then cause a copy to be sent to the representatives of both parties to the dispute. The original award, together with any shorthand notes and all relevant papers, shall be forwarded to the Board of Trade.

8.—Shorthand notes (and transcripts of such notes) of any part of the proceedings shall only be paid for by the Board of Trade if the Chairman of the Court certifies that the notes were necessary for the purpose of the Court. The Board of Trade will also pay any expenses connected with the drawing of the award, and for the hire of a room for the hearing of the case when necessary. They will also pay the expenses of the members of the Court.

The chemical works at Coatbridge owned by the Gas Residual Products Company, of Glasgow, were last Wednesday destroyed by a fire which is supposed to have been caused by spontaneous combustion in the pitch-house. The oils and tar in the building helped the flames to spread. The damage will amount to several thousand pounds.

THE FATAL GAS EXPLOSION IN BERMONDSEY.

Close of the Inquest on the Second Victim.

The inquiry into the circumstances attending the death of George Henry Langley, which occurred in Guy's Hospital on the 2nd ult., as the result of injuries caused by the explosion in Grange Road, Bermondsey, on the 30th of December, was concluded by Dr. F. J. WALDO, the Coroner, last Tuesday, having been adjourned from the 28th ult. (see *ante*, p. 326).

Mr. CLAVELL SALTER, K.C., M.P., appeared for the South Metropolitan Gas Company; Mr. J. W. GODFREY represented the London County Council, and Mr. T. B. SHAW the Metropolitan Water Board; Mr. F. RYALL, the Town Clerk of Bermondsey, was in attendance for the Borough Council.

Sir *Alexander Binnie*, the first witness called, said he had visited the scene of the explosion several times. The first thing he noticed was that the surface of the roadway was disturbed, and that there were cracks running alongside the tramlines and the kerbs. He had inspected the cavity beneath the roadway opposite the Alaska Works; and it was clear that no explosion took place at the point where the cavity existed. This was most probably due to the whole cavity being charged with coal gas, which, though inflammable, was not explosive without the admixture of a certain quantity of atmospheric air. He subsequently examined the broken spur at the water-main, and found that the whole of the bottom of the excavations was of soft, sandy gravel, and had evidently been recently saturated with water. The fracture or crack to the water-main was one of long standing. The old manhole which connected with the old sewer was wrecked, and the covering or grating had fallen into it, and had not, in his opinion, been blown up. The material which originally formed the cavity had been washed down through the broken crown of the old sewer. Speaking on the matter of the broken gas-pipe, he said that up to a certain point it would be surcharged with earth below the concrete and road setts of the pavement, and the action of the trams overhead would probably break the pipe, which would discharge gas into the cavity, whence it would pass into the old sewer and up the side entrances to the points where the explosion occurred. He had with some difficulty inspected the inside of the old sewer, and had found that it was fractured and broken in every conceivable way. Summing up, Sir Alexander said he thought that there could be no doubt—in fact, the circumstances of the case led to a scientific proof—as to how the explosion occurred. The sequence of events would, he thought, be as follows: (1) At some uncertain period, the spur connecting from the 9-inch water-main became loaded, most probably due to a settlement over the main and the spur being built into the brickwork of the entrance chamber. (2) Following this would gradually be the removal, through the flow of water, of the sand and gravel into the old sewer. (3) Owing to the support being removed from the gas "rider," it would deflect and come back. The old sewer would be partially filled with gas and form an explosive mixture which would pass up the old side entrances. As to how this mixture became ignited he would leave the Jury to decide. He, however, did not think they would have to go far to discover what, in his opinion, was the most probable cause. It had been given in evidence, and had not been disputed, that within 33 feet of the manhole at Hepburn and Gale's factory there was burning near the watchman's box an open fire, a spark from which would be quite sufficient to ignite the explosive mixture, which in all probability was coming up through some crevice in the cover-plate.

Replying to the CORONER, witness said he was of opinion now that the existing old sewers, of which there were only a few, should be either filled up or removed. If the cavity had been filled with a mixture of gas and air, there would have been a most terrific explosion.

Mr. *J. W. Restler*, formerly Engineer of the Southwark and Vauxhall Water Company, and now Deputy Chief Engineer of the Metropolitan Water Board, explained the circumstances which, in his opinion, led to the explosion. He said that for a long time the earth had been gradually finding its way between the edges of the cover-plates, just as it was now doing at Page's Walk. This eventually resulted in a natural reduction of the support to the gas-pipe, the present position of which showed it to have been deflected from a straight line towards the west. He was of opinion that some agency other than water had been at work to bring about the subsidence or contraction; and he suggested that damage had been caused by a side blow such as could be given by the upending of the cover-plates. He agreed with Sir Alexander Binnie that the ground over the new sewer had settled, and left the 9-inch main partially supported by the arm of the branch resting on the brickwork of the new manhole; and, but for the vibration caused by the explosion, in all probability it would have remained there till now. He submitted that it was impossible that the leakage could be going on for any period anteceding the explosion. Cast iron was a very brittle material, and when subjected to cross strains pipes made of it snapped like glass. When it was subjected to continual strain, such as the branch might have been undergoing, the severance was absolutely complete; and that it was under such strain was, in his opinion, shown by the fact that the 9-inch main itself, after the breakage, was 1¼ inches lower than its original position. The cause of the occurrence was, he thought, the defective condition of the brickwork of the old sewer, the existence of which at the time appeared to be almost forgotten; and all the subsequent events followed in natural sequence.

In answer to the CORONER, witness said that if the old sewer had not existed there would not, he thought, have been any explosion.

Replying to Mr. GODFREY, witness said that if the escaping gas had found its way into the new sewer the same result would have happened as in the present case; and it was only by accident that it got into the old sewer.

Professor *Vivian B. Lewes* said he had examined the scene of the occurrence, with the result that he considered there were two serious points of explosion, and there had also been a minor explosion at a third point. The conclusion he came to as to the course of events was that the fracture of the gas-pipe opposite the Alaska Works was the source from which the gas had come. This gas, making its way into

the old sewer, had gradually driven out the air, and at this point the sewer contained practically pure gas. But as the mixture passed up the sewer, the percentage of air in it increased, and at a point near No. 52 in the road, the upward explosion limit had been reached —this being a mixture consisting of 23 per cent. of gas and 77 per cent. of air. Any mixture richer than this would burn and not explode. Beyond this point, the percentage of gas gradually became less, until at a point near Messrs. Hepburn and Gale's they had a mixture of nearly explosive power, which with the South Metropolitan Company's gas would be between 16 and 17 per cent. The opinion he formed was that the explosion had started at or near this point, had flashed back in the main, and ultimately reached a side entrance at No. 52. In the entrance to the sewer there was a fairly large chamber; and the air and gas passing into it gave again a mixture of maximum explosive power. From what he saw, it appeared to him that no explosion took place at Messrs. Hepburn and Gale's. There must have been a recoil. He thought the explosion passed from Messrs. Hepburn and Gale's down towards No. 52, because one witness said he saw a flash of light reflected at the time on a venetian blind. This suggested that an explosive wave was passing out, and blew before it through the side entrance, in an ignited condition, a body of gas so poor in its mixture of air as to have been luminous. With regard to the breaking of the "rider" pipe, he had not the least doubt that it was caused by the removal of the soil leaving it without support. The weight caused it to sag and break. The real and the original cause of the disaster was undoubtedly the leaving of an uninspected sewer below the surface of the road, which appeared to him to be one of the most dangerous practices that could be allowed in a populous city. Witness went on to inform the Coroner that he had made a long series of experiments with the electric lamps used by the Gas Company's men, and though he had subjected them to the most severe tests, he was bound to admit that they were perfectly safe.

Replying to Mr. GODFREY, witness said he considered the old sewers a menace to London; and he disagreed with Sir Alexander Binnie, who had, Counsel stated, advised the London County Council that it was perfectly safe to allow them to remain.

This concluded the evidence.

Coroner's Summing Up.

The CORONER, in summing up, said: We have been told in evidence that on Dec. 30, 1908, two children, Louisa and Alfred Langley, fetched their young brothers from a Christmas party at the Pilgrim Hall, New Kent Road. They were returning home along the Grange Road, Bermondsey, and when they reached No. 50, on the south side of the road, about 8.25 p.m., an explosion took place. Of the two younger children, William (aged 8) was killed outright on the spot; and an inquest was held upon him by the Deputy-Coroner for the South-Eastern District of London. The other brother, George Henry (aged 6), was blown across the road. He was picked up unconscious, and carried to Guy's Hospital, where he died two days later. The fact that his death took place within the Southwark Coroner's jurisdiction has rendered a second independent inquest necessary. This state of the law appears to lead to unnecessary complications and expense; and you may think it desirable to recommend some change whereby all deaths arising out of the same cause shall be inquired into by the Coroner in whose district the first death occurs. The further fact that the cause of the explosion resulting in the death of these children was not ascertained in the first inquiry has left that part of the matter to your subsequent investigation. The violence of the explosion was very great. At all the three side entrances or manholes to the old disused sewer, a large hole was excavated; and in one case at the manhole near No. 52, where the children were, a piece of stone, we were told by Mr. Gamble, the second officer of the London Fire Brigade, was pitched over a house into a garden at the back, where it broke a table in its fall. The men at work at the manhole near No. 40 escaped injury in a marvellous manner, although one of them had all the buttons blown away from his waistcoat. The greatest violence was perhaps evident in the case of the two unfortunate children, one of whom, as already stated, was hurled across the road; while the other was terribly mutilated about the head. Having due regard to the evidence, I think you will have no difficulty in finding that the death of George Henry Langley took place on New Year's Day at Guy's Hospital as the result of injuries due to an explosion of coal gas in the roadway of Grange Road. Our main duty as a Court is to investigate the cause of the explosion. After the mass of evidence, expert and otherwise, that has been laid before you, it is needless to remark that the facts of the case, and the inferences to be drawn therefrom, are complicated and in many ways technical. In summing up the case, however, I will endeavour to bring out the facts that appear most pertinent, with the hope that it will be possible to arrive at some conclusions so far as warranted by the facts of the case and the opinions of the eminent experts who have been called in to give the Jury the benefit of their experience. Grange Road, Bermondsey, lies between the Tower Bridge Road on the west and the Spa Road on the east. It is traversed along the whole length by a single line of tramway, for horse traction. Beneath the roadway there are two sewers—one, the deeper, 15 feet below the surface, is in use; while a second, somewhat smaller and about 9 ft. 6 in. below the surface is closed at both ends. It is important to realize that beneath the Grange Road was a long closed tube in the shape of a disused sewer. The evidence shows that the explosion took place in this old sewer, with such violence that the whole roadway was cracked and fissured. The brunt of the violence, however, fell upon three separate points where the sewer was connected with the road by side entries, at all of which large holes were excavated in the footway. These entries were situated on the south side of the road—the first, to the west, opposite Messrs. Hepburn, Gale, and Ross's leather warehouse; the second, opposite Nos. 39 and 40; and the third, opposite 52, the spot where the children were killed. These points will be referred to for convenience as side entrances 1, 2, and 3. It seems clear that there were several explosions at intervals of a few minutes. How these explosions were related to one another, it is impossible to say with certainty. At the same time, it seems not unreasonable to presume that there was, in the first place, a point of ignition of the inflammable gas in the sewer, and that the other explosions were directly or indirectly the result of the first. Nor does it seem possible to say at which point the first explosion took place. One thing is clear, however—that at the time of the explosion three workmen of the South Metropolitan Gas Company were at work close by the side entry No. 2. They had removed several paving stones, and dug a hole whereby the gas-main was exposed. Their object was to search for a leakage of gas which had been reported at the Company's office. They were provided with two electric safety lamps, tarred rope, and various implements. The next question is, How did the gas become ignited? Near side entry No. 1 there were a dozen or more ordinary watchmen's lamps and an open-fire some 30 feet from the cavity. In the open air it is improbable that an explosive mixture issuing from the side entry would be fired at a distance of 30 feet. Still, it is not impossible. Our attention is naturally drawn to the workmen at No. 2 side entry. They state that a single safety electric light was used before the explosion, at a distance of 3 or 4 feet from the side entry to the old sewer. With regard to another possible cause of ignition, some serious allegations have been made; and to these I would ask your most serious consideration. We have it from the foreman that tarred rope was in his possession. But both he and his three workmen deny having used either the tarred rope as a torch or any other naked light. In this they are to a certain extent supported by the evidence of Miss Gill, a young lady who lived at No. 40. On returning home shortly before the explosion, she noticed an enclosed light, but no naked light, and saw nothing more on looking out of a front room shortly afterwards. A young man named Cannon, who reached the house a quarter-of-an-hour later, noticed no lighted tarred rope or open light. On the other hand, certain witnesses have sworn to having seen the gas employees using a naked light or torch prior to the explosion outside No. 40. J. H. Hazell said while walking with his wife in an easterly direction in the Grange Road, on nearing No. 186—"The Earl of Derby" public house—at about twenty-five minutes past eight p.m., his wife said to him: "Look, Jack, what a funny thing to have a lighted torch repairing the road." He looked across the road and saw a tall man standing beside a hole outside No. 40 swinging a lighted rope. It was a flaring light the man was swinging round and round as he stood by a hole, which caused a large circular flare. The light was being swung round, so Hazell thought, in order to get it better alight. They crossed the road to the corner of Crimscot Street; and on reaching No. 49 Grange Road, the witness heard a terrible bang and saw earth going up and a boy fall to the ground from the air. Mrs. Hazell corroborated her husband's evidence, and said that she remarked to him at the time "What a funny thing to have a naked light over a hole like that," to which her husband replied, "Oh, those men know what they are doing." It should be noted that Dr. Martin, of No. 45, Grange Road, stated in evidence that on the morning after the explosion Mr. Hazell told him that he and his wife had seen the man swinging the tarred rope. Mrs. Barnes, who lives at No. 39, Grange Road, states definitely that about 7.30 p.m. she went to the gate and saw three men, "One man," to quote her own words, "was holding a light like a piece of rope in his hand, and looking into the hole. He held it in his hand. They also had some small lamps, electric lamps, I should think. At a quarter past eight, they were using the same light when my sister-in-law came. She saw them at that time." Mrs. Sweeting (the sister-in-law in question) confirmed the story of the lighted rope. Another witness, Thomas Toomey, a plumber, states definitely that he saw a tall man working with a lighted tarred rope in the hole. It is for you, Gentlemen of the Jury, to decide between this contradictory evidence. I ask you to decide whether the positive evidence is such as to point to the use of a lighted tarred rope by the employees of the Gas Company; and if you arrive at that conclusion, to say whether or not, in your opinion, it was the cause of the explosion. As regards the possibility of electrical ignition, we have been told in evidence that the arc lamps in the Grange Road were alight at the time of the explosions, and remained alight throughout and after the explosions; also, that the Borough of Bermondsey's electrical cables running through the road were uninjured. Perhaps it would be best now to mention three smaller explosions which took place in quick succession about half-an-hour after the first explosion. They were at the Mason's Arms and the two next houses on the opposite side of the road from 25 yards or so east of No. 3 side entry. It was clear from the nature of the evidence that these smaller explosions were due to the escape of gas in the houses affected as the result of the destruction of drains caused by the first explosion. This relation of cause to effect will be more evident when we have discussed the starting point of the first explosion—namely, that in the old sewer. The existence of the two sewers in the middle of the street has been already mentioned—namely, the disused one in which the explosion took place at a depth of 9 ft. 6 in.; and the new one at 15 feet. There were two water-mains on the south side of the roadway—a 4-inch main and a 9-inch one. There were also two gas-mains, one on each side of the road, joined at various points by a cross pipe, called a "rider." One of these connecting pipes is situated about 50 yards east of No. 3 side entrance hole, opposite the Alaska Leather Works; and I think no one who has heard the evidence can dispute that the gas which entered the sewer and caused the explosion escaped through the fracture of this 5-inch gas "rider." The circumstances under which this discovery was made are peculiar and interesting. After the explosion, an examination revealed the existence of an extraordinary cavity beneath the surface of the roadway opposite the Alaska Works. This cavity was 6 feet in depth, and 13 feet long by 15 feet wide—in short, about the dimensions of a small bedroom. Its roof was formed by the thin layer of concrete and granite setts carrying the rails of the tram-lines. Sir Alexander Binnie thinks the hollow must have been in existence for some long time, as he found two high water tide marks on the sides. In any case, this frail support had borne the weight of the tramway and the vehicular traffic. A close examination of the cavity showed the leakage of gas to have come from the "rider," which was broken in two places, and sagged. The cause of the hollowing was undoubtedly the action of water, which was traced to a broken branch or curved "spur" leading from the main. This "spur" was the remnant of a pipe that once led to the Alaska Works It had been cut off short, and sealed with a cap. Later, a shaft was sunk to the new sewer and partly involved the "spur" in its brickwork. The next step appears to have

been a subsidence from some cause or other of the main water-pipe. The "spur," owing to its fixed position of attachment to the shaft, not being able to descend along with the main, naturally broke across. The actual fracture of the spur took place 4 or 5 inches from the shaft, according to William Cupit, the district gas foreman, who was one of the first to enter the cavity. I think we shall most of us agree with Sir Alexander Binnie, the eminent Engineer, and Mr. Angel, the Borough Surveyor of Bermondsey, in regarding this leak as the starting point of the cavity. The water coming from the pipe acted precisely as a spring does in any sandy and shifting soil. The water appears to have been carried off by the old sewer, access to which was obtained by the wearing away of an old shaft piercing the crown of the sewer. In proof of this assumption, a quantity of earth was found in the old sewer. The sequence of events is simple enough to follow. First the subsidence, the fracture of the water-pipe spur, the hollowing out of a large cavity in the soil, the fracture of rider between the gas-main, and, finally, the pouring out of a huge volume of gas whereby the old sewer was filled with an explosive mixture of coal gas and air. A few words will now suffice to explain the mechanism of the secondary explosion at the Mason's Arms and the two neighbouring houses. In making the new sewer at a lower level, the house drain-pipes were carried through the old, or disused, into the new, sewer. Some of them were dislocated or broken by the first explosion, and the gas subsequently poured into the old sewer, traversed the drain, and entered the houses where the secondary, and fortunately less serious, explosions took place. The question as to who is ultimately responsible for the explosion raises somewhat complicated issues. Apart from the question of the possible agency of the gas employees in actually causing the ignition, there are other points to consider. For instance, was the system of the Gas Company, of the Water Company, and of the Local Authorities reasonably efficient to secure the safety of a complicated relationship between gas, water, and sewer pipes? These issues are too wide to be dealt with in a Coroner's Court of inquiry. In this particular case, however, the gas would not have escaped had not the water washed away the cavity. The cavity in itself would not have become a serious danger menacing the safety of the whole street, had not the old sewer been present. Nor, in all probability, would the Water Company's spur have become broken had it not been fixed in the brickwork of the shaft to the new sewer. We have it given in evidence by Mr. Robert Gloyn, the District Engineer of Sewers to the London County Council, that the shaft to the new sewer was put down in 1881. If it has been shown, in your opinion, that the inclusion of the spur in the brickwork was the cause of the leakage of water that led to the formation of the cavity, then the authority answerable for that inclusion must be responsible for the subsequent damage arising therefrom. With a view of preventing similar untoward occurrences in the future, it would be well to ask for an inquiry as to the prevalence of disused sewers in London, and whether it would not be desirable to fill them up, or at any rate secure a free system of ventilation; secondly, whether it would not be advisable to encase gas and water pipes in concrete when laid in shifting soils. The questions now for me to put to the Jury are:

QUESTIONS BY CORONER WITH UNANIMOUS ANSWERS OF JURYMEN.

(1) How, when, and where did the deceased, George Henry Langley, meet with his death?—By gas explosion, Dec. 30, 1908, in Grange Road, Bermondsey.
(2) Was the main explosion or series of explosions in Grange Road due to the ignition of a mixture of coal gas and air that had collected in the disused sewer in Grange Road?—Yes.
(3) Was the ignition caused by the use of lighted tar rope or naked lights by the South Metropolitan Gas Company's employees?—We are of opinion that lighted tar rope was used by Gas Company's employees, and caused the ignition.
(4) Was the escape of coal gas due to the fracture of the "rider" or cross-pipe connecting the parallel gas-mains near the Alaska Leather Works?—Due to the "rider."
(5) Was the fracture in the gas-pipe "rider" due to the washing away of the soil by an escape from the 4-inch spur attached to one of the water-mains?—Yes.
(6) Was the spur broken owing to the fact of its being partly fixed in the brickwork of the shaft leading to the new sewer?—Yes.
(7) Who, in your opinion, was responsible for the inclusion of the spur in the brickwork?—The responsible owners of the sewer.
(8) Would you suggest an official inquiry into the condition of old disused sewers or into the means generally of preventing any similar explosion in future?—Yes.
(9) Finally, do you consider the evidence before you sufficient to warrant you in saying whether the death of George Henry Langley is due to negligence on the part of any person or persons or of the want of reasonable precautions and care on the part of any public body or bodies, or, if not, do you consider death due to accidental causes?—We find that George Henry Langley met his death as follows: Due to the negligence of (1) the London County Council; (2) the Metropolitan Water Board; (3) the South Metropolitan Gas Company, who should be held jointly liable. *Rider.*—We do not consider the Gas Company's men criminally negligent.

The Proposed Purchase of the Bath Electricity Works.—The Bath Electric Lighting Committee have decided to recommend the Corporation to rescind the agreement with Mr. Ernest Schenk, under which he was to acquire in perpetuity the concern which was municipalized in 1896. The amount of the capital involved, which Mr. Schenk was to repay in thirty years by instalments, was £162,939; and the Corporation were to secure other material advantages in the way of reduced charges for street lighting and free current. The Board of Trade refused their assent to the scheme, whereupon Mr. Schenk promoted a Bill, and called upon the Corporation to support him. Before doing so the Corporation sought an interview by a Committee with the Board of Trade; and having ascertained that the Board took a very serious view of the proposal to sell in perpetuity when Parliament had expressly protected future generations, and that the Board would oppose it, they advised that the matter be not proceeded with.

THE PUBLIC LIGHTING OF CALCUTTA.

An Interview with Mr. J. G. Newbigging.

Reference has recently been made in the "JOURNAL" to the fact that the Calcutta Corporation had invited Mr. J. G. Newbigging, the Gas Engineer to the Manchester Corporation, to proceed to Calcutta to advise them on a new scheme under consideration for the lighting of the streets of the city, and that, in view of important work now in hand at Manchester, it was impossible for him to be absent from duty for so long a time as the visit to India would have required. Mr. Alfred Mansfield was subsequently appointed in Mr. Newbigging's place. We have since received a copy of the Calcutta "Statesman," dated the 9th ult., which records the decision of the Special Committee of the Calcutta Corporation who had in hand the consideration of the question of the gas contract that it was necessary to obtain some expert advice before proceeding further in the matter. They accordingly determined to cable to the Manchester Corporation asking if they could lend the services of their Chief Gas Engineer for two months to the Calcutta Corporation, to advise them in connection with the tenders then under consideration. This conclusion was arrived at after perusing notes on the subject prepared by Mr. J. G. Apcar and by Mabaraj Kumar Hrishi Case Law.

Mr. Apcar's note, which sets forth his account of an interview with Mr. Newbigging, was in the following terms.

During my late visit to Europe, I made a journey to Manchester, with the object of gaining information on the subject of the lighting of public streets. There was the particular advantage in seeking opinions in Manchester on the question, because that city is lighted both with gas and electricity, and the Manchester Corporation own their own works for both classes of lighting; gas being mainly used, and electricity in certain selected areas. I saw the Chief Gas Engineer (Mr. J. G. Newbigging) and the Chief Electrical Engineer (Mr. S. L. Pearce); and I have learned sufficient to be strongly encouraged to appeal to the Commissioners on no consideration to enter into any contract for lighting until they shall have been advised, on full material, by properly qualified and independent expert opinion. In this connection, I perhaps may usefully quote Mr. Newbigging's own words: "It will be perfectly ridiculous for Calcutta to enter into a contract without expert guidance." Mr. Newbigging added, it must not be supposed that he seeks that his own opinion should be taken. He would be willing to give it; but certainly expert opinion on their own behalf should be taken by the Calcutta Corporation, and of an engineer preferably not connected with any Gas Company. Mr. Pearce (whom I had previously interviewed) expressed his opinion in the same sense.

Mr. Newbigging instanced the manner in which business is done in Great Britain. He explained that a Joint Committee of Leith Burgh and the Edinburgh Corporation had made recommendations for lighting; and he had lately been consulted by the Edinburgh Corporation to advise that body with regard to the recommendations of the Joint Committee referred to. It will be observed that a large city corporation did not depend on their own city engineers; and so carefully are public interests safeguarded in Great Britain, and so difficult are the questions involved considered to be, that such a body sought outside opinion of an expert, to protect themselves in respect of the recommendations of a Committee on which were included their own nominees, selected from among themselves. We here, in Calcutta, have been urged to regard as sufficient the expert guidance of the manager of the proposed contractors, who are the only tenderers. In the nature of things, it is to be expected that there should be—and, in fact, there are—many and conflicting interests between the public and the Oriental Gas Company. I am not concerned to discuss the question of the *bona fides* of Mr. Watson, their Manager. Obviously, his first concern should be the interest of his shareholders.

It will be recalled that the proposal, which has been made by the Oriental Gas Company through their Manager, has passed unchallenged by our Engineer, and is on the way of acceptance, is that we should pay a fixed price for lighting each lamp for certain stated candle power, without regard to the amount of cubic feet of gas consumed. An estimate of the consumption has been given, but only to satisfy my personal inquisitiveness; and it forms no part of the tender. Mr. Newbigging informed me that an average meter system is in ordinary use, the number of lamps to each varying; that, for a level area such as we have in Calcutta, he thought we might include so many as 200 lamps to each meter; that it was essential that the amount of cubic feet of gas consumed should be known, in order to know what candle power was being given; and that the contractors should guarantee the illuminating power per cubic foot of gas consumed in an incandescent burner. He further said that, rather than pay a fixed price, it would be better to pay on an average meter system. Again, under the tender, the price for each lamp proposed to be used is at Rs. 55. It has always struck me as being an enormously high charge; and I inquired regarding lamps at a cost of £3 (Rs. 45) only for each. His reply was given with an emphasis there was no mistaking. Then the contractors, he said, would be giving a most excellent lamp; that suitable lamps could certainly be obtained at a lower rate.

He decidedly was against a long period for a contract, and strongly condemned the idea of a contract for twenty years; and yet under the contract in contemplation, we shall be penalized, by over Rs. 5 lakhs on account of lamps only, if we accept their tender and fail to give to the Oriental Gas Company a contract for twenty years. Although he himself is a Gas Engineer, and in favour of gas in the present day, he advised that, for a selected area, electric lighting should be adopted. He considers that, in view of the improvements being effected in electric lighting, and the possibilities even in the near future, it would be a wise plan to gain experience in the latter medium. He estimated that the fee payable to an expert would be 50 guineas to 75 guineas, according to the labour that would be entailed.

It will be perceived that, apart from any question of price to be paid for gas, the principles on which we have been proceeding are divergent from those on which contracts are based, when corporations, acting on proper information, are concerned; and that, with regard to the lamps, not only is serious doubt created that we shall be incurring needlessly

extravagant expenditure, but that our successors will be driven to grant an extension to the Oriental Gas Company on their own terms, for twenty years, probably to the prejudice of the Calcutta public. I need hardly assert that it is incumbent on us to leave the hands of future Commissioners as free as possible to instal such system of public lighting as, at the time of reconsideration, shall be the best available.

I have had the advantage of reading an instructive note, written by Maharaj-Kumar Hrishi Case Law. It will repay careful perusal, and no doubt will receive the consideration of the Commissioners that it so well deserves. One will perceive, among other points dealt with in the note, the careful provisions made in Great Britain, by Statute, to maintain the standard of lighting, and how, when the local authority—such as the corporation—fails, or is negligent, powers are reserved to outside authority to intervene. Mr. Watson brushed aside my suggestions regarding the use of water gas, to cheapen the cost of the gas supplied. Of course, the question of its use would depend on the price of coal. If it is cheap, there would be no necessity for water gas. But the objection taken was to the poisonous effects of water gas in use. I learned from Mr. Newbigging that such gas is being used in England now without fear; and if it can be used without risk in English homes, in India, with more open houses and freer ventilation, there would be even less risk. The Maharaj Kumar's note has been compiled from text-books of recognized authority, and after reference to English Statute Law, if our Chief Engineer, who has been our only technical adviser, other than Mr. Watson, had information regarding the important points to which our attention is drawn by the note, he did not give us the benefit of his knowledge. In every inquiry, in every test, we find in the result under what ignorance we labour. It is quite possible to obtain advice from England; and the cost cannot be regarded as excessive. Our present contract expires in 1911; and we should be able to obtain advice in six months.

In view of the use that has been made of my criticisms of the proposed contract, for controversial purposes, I beg again to explicitly state, I am not, and I never have been, opposed to gas as our illuminant. While I have favoured electric lighting for a limited area, I have consistently supported the adoption of gas for the general lighting of Calcutta, but on business lines, and not at any cost. If, in the result, the Oriental Gas Company insist on demands that are oppressive, and if, after consideration of all aspects of the question, we think it advisable to instal our own plant for lighting with gas, I believe we might confidently appeal to the Government for legislation, if it be needed, to carry out such a scheme. In any event, I submit it will be advisable to consider whether a Gas-Works Act is not required for Calcutta.

The second note—that prepared by Maharaja Hriski Case Law—was as follows.

At the eighth meeting of the Gas Committee, it was resolved that "the Gas Company having offered the Corporation 20 per cent. more gas for the same price as is now paid, the Corporation do get the advantage of that 20 per cent." on the basis of the present 24-candle power. But the Committee have not taken into account that "the volume of gas used for the purpose of lighting has considerably diminished in proportion to the amount of light obtained from it, owing to the vastly superior efficiency of the incandescent method of lighting now in general use, over the lighting systems of twenty years ago" (see Webber's "Town Gas"). In England, the legalized standard of 20 to 21 candle power was reduced to16-candle power by the effort of the South Metropolitan Gas Company in the year 1900. It was expected that by thus lowering the quality they would get cheaper gas, and that the new and lower-priced gas would prove as good as the old one. So it was about this time that the London standard was uniformly made 16-candle power. Finding that the efficiency of the light was not lowered by reducing the statutory illuminating power, in Scotch burghs where rich gas-producing cannel coal is cheaper than that used in London, movements for reducing the quality to the English standard candle power have already made considerable progress, and have thus lowered the price of gas. It is therefore evident that the Calcutta standard of 24-candle power is much higher than what it was in England or Scotland about 1890; and if the Corporation deem fit to reduce the high-candle power of 24 to the English standard of 16, and if the recent improvements in the incandescent system of lighting be adopted to improve the efficiency of light, the Gas Company would not only be able to manufacture gas cheaply by using ordinary bituminous coal, but the surplus profit arising from this saving in gas would go towards other improvements. Thus neither the suppliers nor the consumers will have to raise their expenditure to get this efficiency; and in the end the Gas Company would be able to declare better dividends, as is evident in the case of the South Metropolitan Gas Company, which in 1901 "re-organized the public street lighting throughout South London, providing new and improved lamp-posts and lanterns of an elegant pattern"—recouping themselves from the saving in gas under the new incandescent system spread over a number of years. The local authorities and the public were benefited by the enjoyment of the improved lighting without any extra charge. Mr. Charles Hunt says: "The cost of street lighting appears very little, if any, more than that which obtains in the case of lighting with ordinary flat-flame burners, though the amount of light is increased about fourfold. The cost, however, varies. An early installation of ten lamps in St. Vincent Street, Glasgow, was attended with very favourable results—a saving of about £11 the first year being effected after paying off the cost of the new burners and the charge for renewal of mantles" ("Gas Lighting," in "Chemical Technology.").

In the Earl's Court Gas Exhibition of 1904, it was clearly shown that the best result in street lighting had been obtained by Welsbach "C" with governor or regulator or Kern No. 4 incandescent burners in stout, well kept-up reflecting top lanterns of Sugg's patent, spaced 50 yards, so that anyone could consult his watch in the streets and also read an address-card or envelope. The available efficiency of the Welsbach "C" burner with good mantle is 80-candle power for a consumption of from 3½ to 4 cubic feet of gas per hour; and that of the Kern No. 4, 100-candle power. So having regard to London experience, and Paris having followed the English method with their improvements in gas lighting, there cannot be any likelihood of an increase in the consumption of the volume of gas from 4·28 to 5 cubic feet, as stated; and the statement made by Mr. Watson that "in the newer forms of incandescent gas-burners it is found the higher consumption of gas conduces to an increase in the candle power per cubic foot of gas consumed, and as the consumption is reduced the candle power obtained per cubic foot of gas used is also reduced," does not find any support.

As to supplementing coal gas with carburetted water gas, the economy in production and luminous power referred to by Mr. Apcar at a previous meeting will be specially felt where the price of coal is high, and where "the fuel value of heavy petroleum oils unfit for burning in lamps is made available for public service," as has been the case with America, where, on account of the abundant and cheap supply of natural oil, "so large a proportion as one-half to two-thirds of the illuminating gas now used in America should be carburetted water gas." In the United Kingdom, fear was expressed about its poisonous quality; and Mr. Webber says on this point: "A Home Office Committee inquired into the matter, but no action was taken; the evidence of increased risk being inconclusive. Since then the manufacture has so greatly extended in municipal as well as privately-owned gas-works, that it would be extremely difficult to restrict it, even if such a course were indicated as justified by a sufficient body of testimony, which is not the case." In Calcutta, where the supply of coal is cheap, the auxiliaries to enrich coal gas are not necessary.

From a financial point of view, there are two methods open to us for consideration: (*a*) Vary the gas consumption, by keeping the 24-candle power constant; (*b*) vary the candle power standard to 16, by keeping the gas consumption constant. Both of these methods, if judiciously applied, are feasible; but the economical result of (*b*), as per Glasgow experience stated above, would seem to be more favourable than (*a*). The following figures would make my meaning clear: Proposal (*a*)—The volume of gas consumed by the old lamps was 4·28 cubic feet per hour per lamp, less 23 per cent. of 4·28 = 0·98. Hence, saving on lamps 8862 × 3650 hours = 32,346,300 lamp-hours; 8862 × 160 hours extra = 1,417,920; 33,764,220 × 0·98 = 20,088,935 cubic feet at Rs. 3-8 per 1000 cubic feet, as per contractor's schedule to supply gas to Municipal building = Rs. 1,15,811·267, or, say, a saving of Rs. 1,15,811. Available gas for street lighting being 4·28 — 0·98 = 3·3 cubic feet per hour per lamp of 24-candle power. The efficiency of light when the Welsbach "C" burner or Kern No. 3 with governor is applied being equivalent to about 80-candle power. Proposal (*b*)—Following the St. Vincent Street experience, as stated above, there was a saving of £1 2s. per lamp (standard candle power 16), or, say, Rs. 16 per lamp. Therefore, 8862 lamps × 16 = Rs. 1,41,792. The efficiency of light with the above burners would be the same. It is now for the Committee to consider which system they would adopt.

In the specification for gas lighting, it is stated that the gas "shall be tested and examined by the analyst to the said Corporation and the analyst to the said contractor;" and "all costs and expenses whatsoever in connection with such testing and examination shall be paid, defrayed, and borne by the said Corporation and the said contractor in equal shares and proportions." In London, the practice, however, is different. In the (British) Gas-Works Clauses Act, 1871, section 28, it is provided that "the undertakers shall cause to be provided at the place prescribed and within the prescribed time a testing-place with apparatus therein" for the purpose of testing the illuminating power and purity of the gas supplied by the undertaker; and in section 30 it is also provided that "where the testing of gas is imperfectly attended to by the local authority, two Justices may appoint some competent and impartial person to be gas examiner." In the (British) Commercial Gas Act, 1875, section 22, it is also provided that the Board of Trade "shall appoint in relation to the Commercial Company three competent and impartial persons, one at least of them having practical knowledge and experience in the manufacture and supply of gas, who shall be called the Gas Referees." My proposal is that with the Corporation analyst, who has some practical knowledge of the business, two Municipal Commissioners—say, a doctor and an engineer who have some knowledge of chemistry—may be appointed, with a view to certify the proper testing of gas; and to this I do not think the contractors can reasonably object. I do not raise the question of the cost of testing, as it would be small; but I do insist that the contractors should affix at their own expense "to each lamp the instrument known as a street-lamp governor, and the undertakers or local authority shall be entitled to have access thereto for the purpose of examining the same," as provided in the Gas-Works Clauses Act, 1871, section 26, with regard to English towns.

Explanations by Mr. Newbigging.

A print of the preceding article was submitted to Mr. Newbigging to enable him to substantiate or otherwise the statements contained therein, and the following is his reply.

The conversation I had with Mr. Apcar was of a very general nature on the question of public lighting, but as reported is substantially correct. I am glad, however, you have given me the opportunity of perusing the account, so that I can make one or two of the statements clearer.

It is quite true that I said it would be perfectly ridiculous for the Calcutta Corporation to enter into a contract for the lighting of the city for so long a period as twenty years without expert guidance, and that no corporate body in this country would bind itself entirely to gas for so long a period, without being at liberty to experiment with electric lighting in selected areas of the city, in view of the rapid advance in the science of artificial illumination.

The reference to the Edinburgh Corporation was with regard to the recent lowering of the illuminating power of the gas supplied by the Edinburgh and Leith Commissioners; there being an analogy between the Edinburgh and Calcutta Corporations, neither having a Gas Engineer, and consequently requiring to call in outside advice when questions of public interest are concerned with regard to the gas supply.

The statement as to the adoption of the average-meter system was in reply to Mr. Apcar's inquiry as to how the Calcutta Corporation could be effectually safeguarded with regard to the consumption of gas in the lamps, and their candle efficiency; he not being prepared to accept

entirely the statement of the Gas Company's official on the point. The criticism of the cost of the lanterns for ordinary incandescent lighting was in view of the large number required, judging by the expenditure proposed to be incurred, and that if public tenders were invited to specification, no doubt they would be obtained at a cheaper rate.

Mr. Apcar asked me what the expert advice would cost; and I replied that if it was merely a question of perusing the proposed agreement between the Oriental Gas Company and the Calcutta Corporation, and giving an opinion thereon, 50 to 100 guineas would cover it. It had no reference to a visit to Calcutta, as that was not mentioned at the interview. In the cablegram to my Chairman, asking that I should be allowed to visit Calcutta and advise the Corporation, he was asked to name the terms for such an arrangement.

You are quite at liberty to publish this letter along with the extracts from the Calcutta paper; indeed, I would prefer that you did so.

ILFRACOMBE GAS COMPANY.

Directorate and Official Changes.

A Special Meeting of the Ilfracombe Gas Company was held at the offices on Monday last week, under the presidency of Mr. W. C. Rafarel, to elect a Director in place of Mr. R. Lake, J.P., deceased; to authorize the Directors to pay a pension to the retiring Secretary (Mr. C. B. Ball); to elect him an additional Director; and to fix the salary of his successor. A vote of condolence and sympathy with the widow and family of the late Mr. Lake having been passed, Mr. Finch remarked that Mr. Ball had found it necessary to relinquish the position of Secretary of the Company, with which he had been associated for 26 years. He thought the present occasion was a convenient one to do so, and had resigned from the date of the meeting. The Directors, however, were anxious not to lose his valuable services; and to this end he should propose that Mr. Ball be elevated to the Board at the usual salary, and that the Directors be empowered to pay him a pension for ten years. He thought it would be of interest if he mentioned that when Mr. Ball first entered the Company's service they had only 450 consumers, which number had risen to upwards of 2000; their output of gas had increased from 13 to 47 million cubic feet; while the price had been reduced from 4s. 7d. per 1000 cubic feet net to 3s. 8d., with a discount of 5 per cent. The shareholders would therefore see how things had altered. The Board thought Mr. Ball's long and faithful service should not go unrecognized. He moved that the Directors be authorized to pay Mr. Ball, during the period of ten years from February 2, 1909, if he should live so long, a pension amounting to two-thirds of his salary. He further proposed that Mr. Ball should be elected an additional Director of the Company, to hold office until the annual meeting in 1912, at the ordinary remuneration. Mr. R. M. Rowe, in seconding the motion, alluded to the esteem in which Mr. Ball was held, and to the energy and ability he had displayed in connection with the Company's business. The motion having been carried, Mr. Ball thanked the shareholders for their expressions of confidence.

The Directors, having appointed Mr. A. Norman as Secretary in place of Mr. Ball, asked to be given a free hand as to arranging his salary up to £150 per annum; and this was agreed to.

Mr. R. M. Rowe was then elected a Director in the place of the late Mr. Lake; and the proceedings closed.

PUBLIC LIGHTING IN ISLINGTON.

Gas to be Continued.

At the Meeting of the Islington Borough Council last Friday, the Public Lighting Committee reported that on the 31st of July last they informed the Council that the Borough Engineer (Mr. J. P. Barber) had directed their attention to the contract with the Gaslight and Coke Company for maintaining the public incandescent gas-lamps in the borough, and had advised that the work could be carried out for considerably less than was being paid under the contract; and on the Committee's recommendation, six months' notice, expiring at Lady Day next, was given to the Company. The total annual cost of the upkeep of 4000 lamps under the existing contract is £5900, made up as follows: Gas Company, for cleaning, lighting, extinguishing, renewing mantles, and maintaining gas-fittings at 28s. per lamp, £5600; Messrs. Pontifex and Co., for carrying out work rendered necessary in consequence of vehicles colliding with the columns, £167; painting, £133. At the instance of the Committee, negotiations took place between the Gas Company and the Borough Engineer, in order to ascertain upon what terms they would be prepared to enter into a new contract; and they have since quoted the following figures: Cleaning, lighting, extinguishing, renewing mantles, maintaining gas-fittings, &c., £5350; painting, £75—total, £5420. They proposed that the contract should be for five years; and their charges were based on a minimum number of 4000 lamps being in use during this period. In consequence of this, an arrangement was come to whereby the Council will retain their right to reduce the number of lamps; and a sliding-scale was agreed upon, under which the prices would be increased in proportion to the reductions. The Committee considered as to whether more favourable terms might be obtained if tenders were invited from contractors; but, from estimates prepared by the Borough Engineer, they did not think this was likely to be the case. They further stated that the Gas Company had carried out the existing contract in a most satisfactory manner; and that unless some further saving could be effected, it was obviously in the Council's interests that the work should be left with them. They expressed the opinion that the proposed new charges, which will effect a saving of £475 per annum, were very favourable, and should be accepted; and they recommended that a contract for five years should be entered into with the Company. The Council approved of the recommendation without discussion.

UNPROFITABLE ELECTRICITY SUPPLY AT LEEK.

A District Auditor's Criticisms.

At a recent Meeting of the Leek Urban District Council, the report of the District Auditor (Mr. H. B. Farquhar) on his audit of the accounts of the Council for the year ending March 31 last, was under consideration. In the course of it, he referred to the deficit of £709 on the electricity accounts, which he characterized as a "serious item," more especially in view of the further heavy capital expenditure to which the Council are committed. He said it appeared that the deficit was chiefly caused by the heavy cost of extensions for supplying power without an available compensating night load; in other words, that the users of electric power were obtaining it at a price unremunerative to the undertaking, and partly, therefore, at the expense of the general body of ratepayers. Both light and power were supplied at prices far below the maximum fixed by the Council's Electricity Order.

Mr. A. H. Moore having referred to several matters mentioned in the Auditor's report, but not to his remarks on the working of the Electricity Department, Mr. T. H. Booth called attention to the omission. He read the paragraph in the report, and said it was very pointed, and required serious consideration. The Auditor almost echoed what he (Mr. Booth) had said all along. To gain customers, they had tried to discredit the Gas Department, and had lowered their price for light and power to take away the customers of another department; and in doing this they were replacing a profitable customer by an unprofitable one. The Auditor only dealt with the result; but he (Mr. Booth) had gone into the official figures. In the account for the year ending March 31 last, the interest on capital was 3⅞ per cent., and the repayment worked out at 3 per cent.—making 6⅞ per cent. The Engineer's report showed that they earned 2⅛ per cent.; so that there was a great leakage somewhere. He had come to the conclusion that they had charged below cost price, and gone in for large extensions of an unprofitable business. The cost of manufacture and the interest and repayment of debt brought the cost of electricity per unit in 1907-8 up to 3¾d. The average price obtained for light and power was 2½d., and for lighting 4½d.; and the cost to make was 3¼d.—showing a profit of £278. The average price per unit for power was 1½d.; and the cost to make being 3⅜d., there was a loss of 2d. per unit, which on 121,509 units amounted to £1012. If they deducted the profit of £278 from the £1012, there was left a net loss of £734, which was reduced to £709 by meter-rents, &c. The manufacturers were paying for electricity one-tenth less than it cost to pay interest and sinking fund, and got all the current they used, with its cost of manufacture, wear and tear of machinery, &c., for nothing. He asked if it was fair to other manufacturers and ratepayers who did not use electricity, or to the gas consumers who lighted the town free, for which the electricity consumers as consumers paid nothing? Gas consumers had also to pay their share of the loss of £709. How was it the Electricity Committee, composed of business men, had been led into this error? How was it the Committee had been led into a further expenditure of £8225, with its interest and repayment of £580, to supply power consumers at so ruinous a loss?

At this point, the Chairman (Mr. J. E. Ingham) interposed to remind Mr. Booth that he had spoken longer than the allotted time; but he said that, if the Council wished it, he could proceed. A desire to this effect having been expressed, Mr. Booth went on to say that if the works had been kept small the Council would not have been in their present position. If a company had been allowed to come in, it would have saved the town thousands of pounds. He thought the Electricity Committee should be asked to make a report.

Mr. J. Morton, a member of the Committee, said they had no wish to waste the ratepayers' money. They were prepared to receive any suggestion that might be of advantage to them and to the ratepayers. If they had made mistakes—which, however, they did not and never would admit—they had done their best. Mr. Bishton said he had opposed the electricity undertaking from the very commencement—venturing to say that it would mean a 6d. rate on the town; and already it was almost a 5d. or a 6d. rate. He asked if they were bound to charge a certain figure to the manufacturers. If not, it seemed to be a simple matter of raising the price. Mr. Shaw remarked that nothing could be said about the propriety of the report of the Auditor. The question now was whether the Council could remedy the defect. He thought both gas and electricity should be supplied at a remunerative price; and he moved that the Electricity Committee prepare a report upon the matter. The Chairman pointed out, however, that this could not be done.

After some further remarks, the Chairman said that since the establishment of the Electricity Committee two serious mistakes had been made; the first being that the Council decided that they must take town gas for their power. In his opinion, this was a great mistake, as it tied their hands for many years. The second was that the Council did not insist that the Committee should be properly treated with regard to the supply and price of gas. The deficits, including the first year, when they only worked a portion of the period, were as follows: 1905, £750; 1906, £536; 1907, £305; 1908, £707. So that the deficit last year was less than the first. If they deducted the amount set aside for repayment of principal, they would find that they lost on the first year £504, on the second £250, on the third £5, and on the fourth £249. If this was true, there had been a great deal more storm over these works than had been necessary. The average prices per unit sold were as follows: 1905, 4·51d.; 1906, 3·91d.; 1907, 3·43d.; 1908, 2·38d. The average cost, exclusive of interest and principal, was: 1905, 7·36d.; 1906, 3·25d.; 1907, 2·49d.; 1908, 1·89d. The business men of the Council knew that the Committee were working under difficulties; and he thought it would appeal to them when he pointed out that they had reduced the cost per unit from 7⅛d. to 1¾d., and the management expenses per unit from 4·67d. to 0·56d. The Committee were told that they ought to put up the price. If the Council decided to increase this and the machinery stopped, he would like them to take a little of the responsibility. In the next few months, they would be getting the full benefit from the plant which had just been put down.

IMPROVEMENTS AT THE BURSLEM GAS-WORKS.

Inspection by the Corporation.

On the invitation of the Gas Committee of the Burslem Corporation, the Chairman of which is Mr. T. Mitchell, a number of the aldermen, councillors, and officials paid a visit to the gas-works at Longport last Tuesday afternoon in order to inspect the alterations and improvements which have recently been carried out there. The party were conducted over the works by the Engineer and Manager (Mr. Edward Jones), who thoroughly explained the process of making gas and preparing it for distribution. In connection with the visit an illustrated pamphlet had been prepared giving a history and description of the works.

The gas-works were transferred from the Burslem and Tunstall Gas Company in 1878; the price paid for the undertaking by the Local Board being £80,000. The make of gas in the year of transfer was 70 millions, and the price 3s. 6d. net per 1000 cubic feet. The area of supply until March last year was the parish of Burslem and the township of Wolstanton; but it is now confined to the parish of Burslem. Since the date of transfer, the increases in the make of gas per decade have been as follows: 1877 to 1887, 53 per cent.; 1887 to 1897, 51·5 per cent.; 1897 to 1907, 46·5 per cent. The first extension for which borrowing powers were required was in 1887, when £4000 was spent on purifiers. Later the same year, a further £2000 was borrowed for the purchase of property presumably for retort-house extension; the loan being for 49 years. No further capital was required until 1897, when the consumption had risen from 101 millions in 1888 to 153 millions. It was about this time that prepayment meters were being taken up, and the adoption of hiring rates for cookers led to unprecedented increases in consumption throughout the country. Burslem rose nearly 30 millions in two years; and in addition to considerable sums being taken from the revenue, £6000 was borrowed for mains, services, meters, and cookers, for a period of sixteen years. The consumption having doubled since 1878, the Gas Committee contemplated in 1900 a scheme to provide for all time, the extensions including retort-bench and machinery, coal-store and boundary wall, a retort-house, gasholder, &c., and involving an expenditure of £31,000. A loan extending over 26 years was granted for them. In 1906, £4000 was laid out for purifiers, new offices, and weighing-machines; and the Committee, desirous of bringing the works up to date, resolved to extend the inclined retorts, whereby all the winter's requirements could be produced by this system. Extensions, comprising the raising of the retort-house walls and the provision of retort-benches, ironwork, and machinery, were carried out at a cost of £4222. In addition to this, there has been spent on a new 30-ton railway weighbridge, a new sulphate saturator, and on the conversion of the old flat-flame jets to incandescent burners throughout the district, a total of £675 12s. The whole amount—nearly £5000—will be taken from revenue; but £4000 of it might justifiably have been capitalized. Generally speaking, no further expenditure to any extent will be required unless the limits of supply be extended.

The area covered by the works is more than 6 acres. The make of gas for the year ending Dec. 31 was 211,057,000 cubic feet; the coal used being 17,536 tons—showing a make of 12,036 cubic feet per ton. The works are so constructed that the producing capacity could be readily and economically brought up to a maximum of 2½ million cubic feet per diem, for which amount the gasholders and purifiers are already provided. The present producing capacity of the works is equal to 1½ million cubic feet. The retort-house is 182 feet long and 57 feet wide. No. 1 section contains four beds each of nine retorts, 24 in. by 16 in. and 20 feet long, equal to 72 mouthpieces. No. 2 section comprises an installation, just completed, of four beds each of eight inclined retorts, with coal bunkers, conveyor, &c. No. 3 section has five beds each of eight inclined retorts, 24 in. by 15½ in. and 20 feet long, with coal elevator, conveyor, &c. The retorts in No. 1 section are set horizontally, and are charged and drawn entirely by manual labour. The whole of the settings are gas-fired, on the most approved regenerative system, each bed having a separate producer. At the south end of the retort-house is situate a coke-breaker. The coke is delivered into the hopper, which is on the same level as the retort-house floor, and passes through the breaker into the boot of a bucket elevator, by which it is carried into a revolving screen. The screened product is delivered either into carts or waggons as may be required. Adjoining the retort-house on the north end is the coal-store. It is 95 feet by 57 feet, and is fitted with a push-plate conveyor.

The condensers are eight in number, of the annular type, 30 feet high and 3 ft. 6 in. in diameter. There are two exhausters. The capacity of the smaller one is 50,000 cubic feet per hour, and of the larger one 80,000 cubic feet per hour. Both are driven by steam-engines. On leaving the exhausters, the gas is treated first of all in a Livesey washer and afterwards in a tower scrubber, 45 feet high and 10 feet in diameter, and then in a Laycock and Clapham washer. The purifiers are eight in number. Nos. 1 and 2 are of Green's luteless type, and are 35 feet long, 22 feet wide and 6 feet deep. In connection with these is a system of overhead runways with travelling pulley-blocks and tipping-buckets for charging and emptying. The capacity of the buckets is 10 cwt. each. Nos. 3 and 4 are water-lute purifiers on the ground floor, and Nos. 5 to 8 are overhead.

The station meter is capable of registering 2 million cubic feet per diem. Its base is 14 ft. 2 in. deep by 13 ft. 3 in. wide.

There are five telescopic gasholders—one of 100,000 cubic feet, two of 150,000 cubic feet each, one of 336,000 cubic feet, and one of 1,500,000 cubic feet. The smaller holders have excavated tanks, are column-guided, and have each two lifts. The tank of the 336,000 cubic feet holder is of cast iron, and is partly above and partly under ground. The largest gasholder has a steel tank constructed entirely above ground. The two latter holders have each three lifts, and are of the Gadd and Mason columnless spiral-guided type.

After leaving the governor, the gas is treated by the carburation plant in use at Hastings for the prevention of naphthalene deposits. Mr. Jones says Burslem is now quite free from napathalene troubles owing to the efficacy of the apparatus, while previous to its installation frequently more than a hundred complaints a day were dealt with.

The plant for the manufacture of sulphate of ammonia is capable of treating 40 tons of liquor per diem. Last year 218 tons of sulphate were produced, worth (say) £11 per ton. The plant is modern, and with the new saturator which will be fixed this summer renders every facility for producing the salt at a minimum cost per ton.

Mr. Jones expressed regret that the show-room, which is well in hand, was not complete at the time of the visit; but he said it would prove a most useful acquisition to the gas-fittings department, and would, no doubt, be of material assistance in developing the business of the undertaking by securing additional consumers of gas and users of gas-heating appliances, &c.

Appended to the description was a schedule giving particulars of working and the amount paid in relief of the rates for each year since 1877. The amount was £58,900, including an estimate of £10,000 for free public lighting, commenced in 1899.

At the close of the inspection, the visitors took tea together on the invitation of Mr. Mitchell. Alderman J. Wilcox Edge expressed their indebtedness to him for the opportunity he had afforded them of inspecting the gas-works and for the entertainment he had subsequently provided. He referred to the benefit which had accrued to Burslem by the acquisition of the gas-works 31 years ago, as shown by the booklet distributed. In the first year, the make of gas was only 67 million cubic feet, whereas it was now 212 millions. The profits during the intervening period had not gone into shareholders' pockets, but into those of the ratepayers. He congratulated the town upon having such a very fine property; and said that, whatever might be the future of the new borough of which they were going to see the birth within a few months, the Burslem Gas-Works, at any rate, would be handed over as a concern of which they might feel justly proud. He would also like to say he thought they had need to be thankful that they had so able a Gas Manager as Mr. Jones. Mr. Mitchell, in reply, said the money the Corporation had spent on the gas-works had been well laid out. He could endorse all that had been said about Mr. Jones, and hoped the works would continue to be as successful in the future as they had been in the past. Mr. S. Johnson said he could fully endorse what Mr. Wilcox Edge had said with regard to their Manager. He considered the results of Mr. Jones's work would justify the new Council in offering him a position. Mr. Jones, in reply, said he hoped to keep up the prestige of Burslem in the new federated area; and he felt he had a Committee who would back him up in his efforts.

SCOTCH RAILWAY COMPANIES & DEMURRAGE CHARGES.

On Wednesday, the 27th ult., Mr. W. R. Herring, of Edinburgh, by telegram, convened a meeting of representatives of the principal gas undertakings in Scotland, to consider the proposed enforcement by the Railway Companies in Scotland of demurrage charges and siding rents, &c. The meeting was held the following Friday, in the Board-Room of the Edinburgh and Leith Gas Commissioners—Mr. HERRING presiding. There were present representatives from Aberdeen, Coatbridge, Dundee, Falkirk, Glasgow, and Perth.

In a narrative of the proceedings, it is stated that the proposed charges which the Railway Companies have intimated will come into force as from Feb. 1, and the regulations for the supply of waggons, &c., were considered and discussed. The meeting was unanimously of opinion that the imposition of such charges and regulations would place additional and unfair burdens upon the gas consuming public, and would seriously interfere with the conduct of gas undertakings, rendering it both difficult and more expensive for the undertakers to fulfil their statutory obligations; and that they should therefore make representations to the Board of Trade, with a view to obtaining a withdrawal altogether of the Railway Companies' proposals, or their material modification so far as gas undertakings are concerned. The statutory obligations upon suppliers of gas, necessitating, as they do, the continuous supply and continuous manufacture, day and night, Sundays, week days, and holidays, also necessitates continuous and regular deliveries of coal. Hitherto this regular daily requirement has not been such (from causes over which the gas undertakings have no control) as to enable them to fulfil their statutory obligations without having a reserve of coal on rail. Hitherto irregular deliveries occurring through traffic manipulation by the Railway Companies, or by their failing to supply empty waggons to the collieries, is counterbalanced by using from such reserve. Further, short deliveries, from the causes mentioned, over one period result in an excess of the daily requirements being delivered immediately following. Consequently, the waggons cannot be cleared within the time stipulated in the proposed regulations. The undertakers realize that the imposition of such regulations and charges would be oppressive, and the penalties exorbitant and out of all proportion to the injuries sustained by the Railway Companies, who, in the majority of instances, are responsible themselves for deficient deliveries day by day—particularly during the periods of trades holidays, and other seasons when passenger traffic is given preference over mineral traffic—and who would likewise be responsible for the excess deliveries after the traffic congestion had been cleared by bringing forward waggons which had been standing back under load, while the undertakers can only use their regular daily requirements. The undertakers are of opinion therefore that the statutory obligations imposed upon gas undertakings are such that they have the right to plead for the total exemption of their traffic from the imposition of the proposed charges and regulations. The undertakers do not argue that the time allowance for discharging waggons is insufficient under normal conditions; but as the conditions of delivery are primarily in the hands of the Railway Companies, and demurrage arises primarily as a consequence of irregular deliveries, the subject is one over which the undertakers have no control, and they consider that they should not therefore be penalized. If total exemption cannot be granted, they are strongly of opinion that the period of detention of waggons should be subjected to the principle of average, on the basis of the time allowance proposed in the regulations. A daily record of

waggons in sidings must be kept under any circumstances; and this record will enable the principle of average to be easily applied. The meeting resolved that a note of the above conclusions at which they had arrived should be posted to the representatives present, and also to other gas undertakings in Scotland; and that a further meeting should be held in Edinburgh on Friday, the 5th inst., when, if thought fit, arrangements could be made for the representation of parties at the Board of Trade, and the terms of any such representation finally settled.

Mr. Herring communicated the following letter he had received in response to a communication he had addressed to the Board of Trade:—

> Mr. H. J. Tennant desires me to acknowledge the receipt of your letter of yesterday's date, on the subject of railway demurrage regulations, and to say, in reply, that he will be very glad to receive representatives from the principal municipal gas undertakings of Scotland, at the conference at the Board of Trade on Monday, Feb. 8, at 11.30, on the subject of demurrage charges by the Scottish Railway Companies. He hopes that the number of representatives will be small.

At the conference in Edinburgh on Friday, the points to be laid before the Board of Trade were adjusted; and the following were appointed a deputation to present the views of the owners of gas undertakings at the conference in London yesterday (Monday): Lord Provost Gibson, Bailie Bryson, Mr. J. M'G. Jack, and Mr. W. R. Herring, of Edinburgh and Leith; Bailie M. W. Montgomery, Bailie T. Paxton, and Mr. Alex. Wilson, of Glasgow; Mr. J. Reid and Mr. A. Yuill, of Dundee; and Lord Provost Cuthbert, Councillor Hamilton, and Mr. W. B. M'Lusky, of Perth.

In the Glasgow Town Council on Thursday last, Bailie W. M. Montgomery, the Convener of the Gas Committee, moved a minute of the Committee recommending that two members, along with the Engineer, be appointed to attend the meeting in Edinburgh on the following day, and also to represent the Corporation on the proposed deputation to the Board of Trade. Mr. Bruce Murray moved disapproval of the minute. The Corporation, he said, were asked to pronounce upon a matter that was affecting the whole community; and they had not before them the information which would enable them to form a proper opinion on the subject. Bailie Montgomery, however, replied that the question affected the Gas Committee of the Corporation. It had nothing to do with the general question of traders and demurrage. Owing to circumstances over which they had no control, the Gas Department could not get delivery of their coal regularly. The consequence was that sometimes they got it in very large quantities, and they were not able to empty the waggons within the time necessary to escape demurrage charges. He instanced the New Year holidays, the busiest time for the Gas Department. The pits at that period were closed; and after the holidays the Gas Department got coal in large quantities. The Corporations of Aberdeen, Dundee, and Edinburgh were of the same view as Glasgow; and he had hopes that a deputation to the President of the Board of Trade would have good effects.

The minute was approved by 37 votes to 20.

SUCTION GAS PLANT EXPERIENCES.

By way of an antidote to all the nice things that have lately been said about gas-engines in general (the "Electrical Times" remarks), Mr. F. V. L. Mathias, of Warrington, sends us a list of answers to a circular which he addressed recently to various station engineers all over the country concerning suction gas in particular. The following places report no serious competition from suction gas—that is to say, it has either been easily overcome or has never became a serious menace: Fulham, Hampstead, Hammersmith, Hackney, Barrow-in-Furness, Bolton, Bootle, Broughton, Bristol, Carlisle, Chester, Crewe, Edinburgh, Greenock, Govan, Keighley, Leeds, Leith, Lincoln, Liverpool, Loughborough, Motherwell, Newport, Nottingham, Patricroft, Rochdale, Southampton, Sheffield, St. Helens, Stalybridge, Sunderland, Wakefield, West Ham, Willesden, Wimbledon, Wrexham, Worksop, Charing Cross Company, Notting Hill Company, South Metropolitan Company, Bournemouth and Poole Company, Kent Company, Liverpool and District Company, Northampton Company, Richmond Company, Prescot Company. Several of the above provincial undertakings report that they have replaced gas-engines by motors.

The following undertakings do not appear to have felt the competition much; but without being precise as to keenness or slackness of this competition, they either record unfavourable experience of suction gas users, or mention cases where electric motors have replaced them: Battersea (users unable to sell gas plant), Shoreditch (displaced three 70-horse power sets), Stepney, Marylebone, St. Pancras (sets of 30 and 40 horse power displaced), Aberdeen (electricity as stand-by), Ayr, Bedford, Belfast, Blackpool (100-horse power displaced), Burton-on-Trent, Cardiff, Croydon (several gas-engines replaced), Darlington (100-horse power replaced), Doncaster (electric stand-by), Grimsby Halifax, Harrogate, Ipswich, Maidstone, Middlesbrough (electric motors obtained large ship yard in competition), Nelson, Norwich, Peterborough (many bad records), Portsmouth (engines replaced), South Shields, St. Annes-on-the-Sea, Stafford, Watford (untransformed electricity at 1½d. replaces engines), Walthamstow, Windsor, York.

The following typical replies are worth quoting in full:—

Accrington.—Have replaced a suction-gas plant which had superseded electric supply for a period of six months. *Re* another suction-gas plant, it is a stand-by. The owner states that, without capital and maintenance charges, the cost is over 1d. per unit. The suction-gas plant has been broken down for five weeks on end. Also know a local cotton-mill which replaced suction-gas plant by steam, owing to unreliability of suction gas.

Blackburn states that suction gas, which a few years ago threatened to be a serious competitor, has completely lost its hold in Blackburn, owing to its unreliability. Know of a case where a 350-horse power suction-gas plant was thrown out for steam, and several others who are endeavouring to sell their suction plant.

Bradford has received an inquiry from a firm using suction gas who state that electricity at 1d. per unit is better than suction gas; and as soon as the plant can be disposed of, they intend taking Corporation supply.

Colchester states that a large engineering firm had a suction-gas plant of 150-horse power; but after two years' running, efficiency fell off badly, and such great trouble was experienced that the firm paid for a large distributor, and took current from the Corporation at 1d. per unit in preference.

Dewsbury.—Regained a firm who had deserted for suction gas. Another firm abandoned a suction-gas plant, owing to trouble with plant and insurance company; and states that electricity at 1d. per unit is considerably cheaper than suction gas.

Dudley.—Have replaced a suction-gas plant of 40 kilowatt. The firm in question state that with current at 1d. per unit, although it has to be converted from direct current to alternating current, electricity is cheaper than suction gas. Also state they have several motors installed with firms using suction-gas plants which are earning a fair revenue; and this reflects upon the reliability, &c., of the suction-gas plants.

Dundee.—Have displaced a suction-gas plant by motors; the firm states that electricity is found to be 10 per cent. cheaper. The following figures are given: Plant, 6 to 15 horse power; coal bill, £20 per annum; attention, £27; interest on capital, £12 10s.; depreciation, £25. Total cost per annum, £84 10s.

Luton states that an engineering firm abandoned suction gas for town gas, and finally gas altogether for electric motors (100-horse power). Another firm is making extensions in electric motors, although it has a suction-gas plant on the premises. Another firm tried suction gas in place of electric motors and found it unsatisfactory, and used town gas, but finds it costs more than original electric motors.

Rotherham.—Have recently connected a timber merchant to the mains, who has made the practical comparison of suction gas and electricity in two other towns.

Warrington.—A firm of corn merchants put down a 40-horse power suction-gas plant three years ago. They state that the plant is by no means all the makers represented, fuel cost has risen enormously, many troubles have been experienced, and maintenance is high. This firm states that had the price of electricity been what it is now, the plant would not have been put in. The question of extension is now troubling them. They are trying to dispose of their suction-gas plant. Current would be about 0·96d. An iron founder put in a 20-horse power suction plant four years ago; it has proved very troublesome; and the owner likewise states that, with current at its present price, suction gas would not have been considered. Current would be about 1d. per unit. A firm of wire drawers, who have a capable engineer and staff of fitters, put in a 30-horse power plant on a 90 per cent. load factor. Troubles have been experienced; and they also state that with current at its present price, gas would not have been put in. The price of current in this case would be about 0·69d. Another firm has a stand-by from the Corporation mains for suction-gas driven dynamo. A fair revenue is obtained from this; so that presumably the gas plant is not altogether satisfactory. A large engineering works having staff of engineers, chemists, &c., states that it costs 0·9d. per unit without capital charges for energy for gas-driven plant of 250-horse power. There are several isolated suction plants some distance from our mains. Most of the suction plants use town's gas more or less, starting-up being usually accomplished by its aid to the detriment of the surrounding neighbourhood.

West Bromwich state they have superseded a suction-gas plant of three 50-horse power engines in large iron-works; the fuel costs were 0·6d. per unit, works costs (water, wages, and repairs) 1·5d. to 2d. per unit. To this has to be added capital charges. Consider that electricity has had a competitor in suction gas; but the extravagant claims made have injured the cause.

Govan mentions a threatened prosecution of suction-gas plant users for nuisance. Greenock's view is that two or three years ago, electrical engineers became nervous of the threatened competition; but the experience of those who tried suction-gas plants was so unsatisfactory that now the danger is practically disposed of.

Suicide by Gas at Bordesley.—Edwin Stokes, aged 33, a Bordesley toolmaker, who was found dead in bed, suffocated by coal gas, had connected an india-rubber tube with the gas-bracket and placed the other end in his mouth. He had been greatly depressed through ill-health; and the Coroner's Jury returned a verdict of "Suicide while temporarily insane."

The Belfast Gas Engineering Assistant.—The Belfast Borough Council have agreed to the recommendation of the Gas Committee that they be authorized to appoint a Gas Engineering Assistant at a remuneration not exceeding £250 a year, to assist in the preparation of the preliminary plans, &c., in connection with the proposed extension of the gas-works.

Transfer of the Wath Gas-Works to the Wath and Bolton Gas Board.—At a recent joint meeting of the newly-formed Wath and Bolton Gas Board and the Directors of the Wath Gas Company, held at the Company's offices, the conveyance of the Company's undertaking to the Board was sealed in the presence of Mr. D. N. Nicholson, the Chairman, Mr. Edward Smith, a Director, and Mr. Tom Nash, the Secretary of the Company; and the Board's seal was affixed in the presence of Mr. William Hallatt, the Chairman, and Messrs. Nicholson, the Clerks, of the Board. The undertaking thus formally passed to the Wath and Bolton District Board on behalf of the Councils, amid many good wishes and expressions for its future success from the late Directors. A few speeches followed, in the course of which expression was given to the opinion that the possession of the gas-works would prove an inestimable boon to the two districts,

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Traders in Scotland are up in arms against a resolution, adopted jointly by the three leading Railway Companies in Scotland, if not by the whole of the Companies, to strictly enforce the regulations for the payment of demurrage for the detention of waggons. This resolution is the result of pressure by the Railway Shareholders' Association, who have already been successful in procuring economies in railway working, in the shape of running fewer trains and the like; so that it is a body possessed of considerable influence. I have not hitherto taken any notice of the movement, because it was of general application. Now, however, thanks to the initiative of Mr. W. R. Herring, of Edinburgh, who, it will be remembered, also took the lead in the matter of the requirement of overhead bridges in gas-works, the subject has been agitating owners of gas-works, and representations are to be made to the Board of Trade as to the prejudicial effect which the new policy will have upon the administration of gas-works. These effects will be found in the statement in another column, regarding the conference which was held in Edinburgh at the end of last week. From this it will be easily concluded that a good deal of inconvenience and expense will result to the owners of gas undertakings from the strict enforcement of demurrage charges. But, notwithstanding this, the Railway Companies have good grounds for imposing the charges. There is a disposition to use the Railway Companies' waggons as stores or warehouses. The position of the Railway Companies is that, whenever this is done, the trader detaining a waggon should pay for it. This is a principle which is incontestable. At the most, therefore, all that the gas traders should look for is a modification of the charges, in the way of average which they suggest, or in some other way. They complain of irregular delivery of coal at some seasons. When this occurs, the Railway Companies should pay. But the subject is a very complicated one, and cannot be dealt with in a few sentences. For instance, the new policy came into force on the 1st inst., and already there is said to have been great loss to workmen in coal pits, because coal owners will not order waggons until they are satisfied that delivery can be taken at the other end; and, consequently, the pit is closed until assurance of acceptance can be given. This illustration points to the hampering of trade, which would not be to the advantage of the Railway Companies. That there is a serious disturbance to trade is undoubted, for it is reported to-day that the Caledonian Railway Company alone have at present 11,000 empty waggons waiting to be ordered. The traders say that but for the demurrage charges these waggons might have been loaded; and to this the reply of the Railway Companies may well be: "Yes; loaded, and kept standing, for your benefit, and at our expense."

In the Inverkeithing Town Council last night, it was reported by the Harbour and Works Committee that they had considered the proposal to acquire the undertaking of the Gas Company, and had instructed the Clerk to write to the Company inquiring if they would be prepared to enter into a provisional agreement for the sale of the works, and also at what price.

The Montrose Gaslight Company—managed by Mr. A. Mackay—in September last announced very liberal terms for the fitting up of gas-stoves. They now make a further advance in their policy of progress, in a circular which they have issued. In this document they state that having been made aware of the fact that, on account of the very much superior light given by incandescent gas lighting as compared with any other illuminant, a great many non-consumers are desirous of using gas, but are debarred on account of the pipes in the interior of their houses being very old or leaky, and some houses being without pipes altogether, they are prepared, for such cases, to supply and fix all necessary piping, brackets, and upright incandescent burners complete for the sum of 4s. per light. In cases where only one light would be used, it will be necessary for the consumer to employ a boiling-ring, for which the only extra charge would be 1s. If there is no gas-pipe from the street into the property, the Company will put one in free of cost. The Company offer to give a light of 80-candle power for five hours for the small cost of 1d. There are only two conditions attached: (1) That the proposed consumer shall free and relieve the Company of all claims in respect of any damage which may be done in connection with fitting-up the installation and piping connected therewith; and (2) the proposed consumer shall use gas for a period of not less than three years. Where a consumer removes from his house within a less period than three years, it is expected that he will continue to use gas in his new house, and also get the incoming tenant to use the installation supplied for him.

As a specimen of unreasoned reasoning, the subjoined letter to the Editor, by Mr. J. B. Coutts, which was published in the "Edinburgh Evening News" on Thursday, the 21st ult., may be of interest. Mr. Coutts wrote: "I notice that in reply to Councillor Bruce Lindsay at the Town Council meeting yesterday, a letter was read from Mr. Herring that the difference in the charge between a 'slot' meter and an ordinary meter—1s. 2d. per 1000 feet—represented the extra cost of collection. This may be so, but in the city of Liverpool the calculated extra cost is only 8d. per 1000. Not only so, but when the price of gas by ordinary meter was reduced last year from 2s. 8d. to 2s. 6d., the Company sent an experienced clerk to a number of other towns to see what should be done to allow a similar reduction to the 'slot' meters. As a result, the latter now get a rebate of ½d. on every 10d. in the meter. Notice that a company, not a corporation, on the report of a clerk, not a deputation, concede this small amount. If the Commissioners were to give 1d. off every 10d., it would still leave 9d. for extra collection. This is a matter that the Ward Committees should bring before the local councillors."

On Thursday evening the gas-works employees in Peterhead held their annual reunion, at which Provost Leach presided, in the absence of Bailie Binnie, the Convener of the Gas Committee. The company included Mr. S. Milne, Gas Engineer, of Aberdeen, and Mr. J. A. Maclay, of Messrs. R. & A. Main, Limited. The Chairman said they

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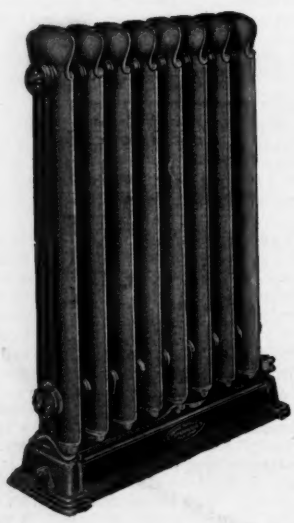

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The Davis Gas Stove Co., Ltd.,

DIAMOND FOUNDRY, LUTON.

were all proud of their Gas Manager, Mr. W. Ritchie. He was a young man who had surprised most of them. Since this time last year, 266 new consumers had been added, and during the past year the gas manufactured amounted to 44½ million cubic feet. The entertainment took the form of a concert, followed by a dance; and it was, as the Peterhead gas-workers' reunions always are, most enjoyable.

At half-past six o'clock on Tuesday morning, a fracture occurred in a 2-feet water main leading from the service reservoir at Alnwickhill, Liberton, to Edinburgh and Leith. The place where the accident occurred was at Nether Liberton, a hamlet to the south of Edinburgh, at the foot of a long declivity. It is 200 feet below the reservoir, which contains from 4 to 5 million gallons of water. This was sufficient to provide an enormous pressure; and, as a matter of fact—the main lying at a depth of 4 feet below the surface of a macadamized roadway—the pressure was strong enough to throw the superincumbent material off, forming a hole about 10 feet in diameter, the escaping water rising into the air to a considerable height. A great flood of water flowed along the broad thoroughfare towards Edinburgh, and reaching the terminus of the cable-car system it filled the pit in which the wheel gearing is situated, rendering the machinery unworkable, with the result that the cars could not be run for two hours. There was a great deal of flooding of lands adjoining; extensive damage being done to grounds occupied as nurseries. The Water Superintendent, when apprised of the burst, shut the water off at the reservoir. As yet, the cause of the fracture is attributed to changes in temperature.

Following up the note in this week's "JOURNAL" regarding the proposed electrical exhibition in Aberdeen, the information is given that, at a meeting of the Aberdeen Town Council on Monday, Mr. Robertson gave notice of motion to remit to the Gas Committee to consider and report as to whether the department should discontinue the supplying of material and fixing up of gas-stoves let out on hire.

The Cleaning and Lighting Committee of the Edinburgh Town Council this week agreed to recommend the Council to accept the offer of the Gas Commissioners to fit up and maintain for three months 100 incandescent gas-lights as an experiment in stair lighting.

In the Peterhead Town Council on Monday, the Gas Manager—Mr. W. Ritchie—reported that the gas-main in Windmill Street was broken in two places, and was otherwise unsatisfactory. He recommended that the present main should be replaced by a 4-inch pipe, and that the service-pipes be laid bare and examined and replaced where necessary, all at a probable cost of £75. The recommendation was unanimously agreed to.

In the residence of Mrs. Darling, at Langsyde, Hawick, on Sunday evening, the gasalier in the front bedroom dropped, allowing gas to escape. After a time the gas was ignited by a side light which had been left burning, and an explosion occurred, which threw down the partition dividing the room from another bedroom, and did other damage. Nobody was injured.

On Sunday last, the work of laying a new water-main from Craigbuscar reservoir to Dunfermline having been completed, the Contractors' workmen were about to make a connection between the new pipe and another main, when it was found that the water could not be shut off, owing, it is believed, to incrustation preventing the valve closing. The pipe having been cut, the pit filled with water, and there was so much delay in the making of the connection that the water supply to the town ran out on Monday.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Feb.* 6.

The market has again been quiet, supplies being freely offered, while buyers have for the most part been indifferent. Consequently, the closing quotations are £11 6s. 3d. per ton f.o.b. Hull, £11 6s. 3d. to £11 7s. 6d. per ton f.o.b. Liverpool, and £11 10s. to £11 12s. 6d. per ton f.o.b. Leith. The forward position has been neglected, and prices quoted can only be regarded as nominal.

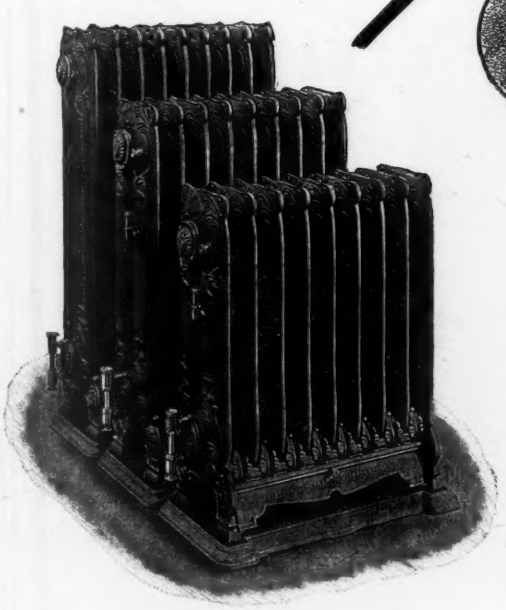
Nitrate of Soda.

This market is weak at all points, and the spot prices have been reduced to 9s. 5¼d. per cwt. for 95 per cent., and 9s. 8¼d. for refined quality.

Tar Products. LONDON, *Feb.* 8.

The markets for tar products are quiet all round, and there is very little business doing in any article. Pitch is quiet, and it is possible to obtain supplies on the east coast at 18s. to 18s. 6d. for January-June delivery; while on the west coast, business has been done at 18s. On the Continent, sales are reported at rather under this figure for January-June delivery; and in South Wales low figures are also reported to have been accepted for water-borne pitch. Creosote is firm. In London, the principal makers are asking 3d. to 3¼d.; but outside makes can still be secured at 2⅞d. to 2¾d., though only in small quantities, for near delivery. In the Midlands, manufacturers are well sold, and are not prepared to consider anything under 2⅞d. to 2¾d. In the North, prices are well maintained when the works are in close proximity to a port; but some of the makers who are a fair distance from a shipping place have sold some quantity for prompt delivery at rather lower prices than have been ruling lately. For immediate delivery in the Manchester district, equal to 2⅞d. *ex* makers' works has lately been offered. Benzol is very quiet. Nineties has been sold at 5⅛d. to the end of June f.o.b., casks included; and it is believed that a firm offer at this figure would induce some of the manufacturers to sell to the end of the year. In London, makers cannot obtain offers over 6d. Benzol, 50-90 per cent., is quiet, as well as toluol, for which there does not appear to be very much demand at present. Solvent naphtha is firm; but there is little business in same just now. For heavy naphtha there is not very much demand. Carbolic is weak. On the east coast, 1s. has been freely accepted for 60's, and 1s. 3d. for 75's;

GRAND PRIX



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No Smell—No Flue Required—Cleanly and Economical—Perfect in Efficiency—Complete in itself—Gas Connection only required—Well Fitted and Finished.

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while on the west coast, 11½d. delivered Manchester has been accepted. Creosote salts remain in about the same position. There has been an improvement during the past week in naphthalene, especially for prompt delivery.

The average values during the week were: Tar, 10s. 9d. to 14s. 9d., *ex* works. Pitch, London, 18s. to 18s. 6d.; east coast, 18s. to 18s. 3d.; west coast, 17s. to 18s. f.a.s. Mersey, 17s. 3d. to 17s. 9d. others. Benzol, 90 per cent., casks included, North, 5½d. to 5¾d.; London, 6d.; 50-90 per cent., casks included, North, 6½d. to 6¾d.; London, 7d. Toluol, casks included, North, 8¾d. to 9d.; London, 9¼d. Crude naphtha, in bulk, North, 3¼d. to 3½d.; London, 3½d. to 3¾d.; solvent naphtha, casks included, North, 10d. to 10¼d.; London, 11d.; heavy naphtha, casks included, North, 10d. to 10¼d.; London, 11d. to 11¼d. Creosote, in bulk, London, 2¾d. to 2⅞d.; North, 2¾d. to 2¾d. Heavy oils, in bulk, 3d. to 3 1/16d. Carbolic acid, 60 per cent., casks included, east coast, 1s.; west coast, 11½d. Naphthalene, £4 to £7; salts, 35s. to 37s. 6d., packages included and f.o.b. Anthracene, "A" quality, 1¼d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market for this article has been quiet throughout the past week, and prices would appear to be decidedly easier, though it is reported that tender parcels have been well maintained in their values. In London, the price is nominally £11 10s. for outside makes upon Beckton terms; but it is doubtful whether this price could be secured. In Hull, business has been done at £11 10s., and in Liverpool at £11 11s. 3d.; and since this buyers have declined to offer at this figure. In Leith, the majority of manufacturers are asking £11 15s.; but they cannot obtain this price, and second-hand business is known to have been done during the week at £11 12s. 6d.

Extensions at the Burton-on-Trent Gas-Works.—Tenders are to be obtained for the erection at the Burton-on-Trent Gas-Works of a gasholder of a million cubic feet capacity in a steel tank, and for replacing the old retort-settings in No. 5 retort-house by Klönne regenerator settings.

Gas Purchase Question at Penmaenmawr.—The Penmaenmawr Urban District Council have been negotiating with the Holyhead and North Wales Gas and Water Corporation for the purchase of the gas-works in their district; and at a meeting of the Council last Tuesday night, a petition, signed by 150 ratepayers, was produced, protesting against the scheme of purchase being further proceeded with, inasmuch as the petitioners considered that the £11,000 asked was far above the value of the concern, and "electricity was superseding gas all over the country." The Council unanimously decided they were not prepared to make any further offer; but if the Corporation would state their lowest price, it would be submitted to the ratepayers.

COAL TRADE REPORTS.

Northern Coal Trade.

There is now a reduced consumption of some kinds of coal; but the demand is sufficient to take up a full output, except when there is a delay of steamers in arriving at the coal ports. In steam coals, the tone of the market is rather quiet; and while 10s. per ton f.o.b. is the quotation of the collieries, some merchants offer at slightly below this price. Second-class steams are from about 9s. to 9s. 6d., and for steam smalls there is the wide difference of from 3s. 3d. to 5s. 3d. In the gas coal trade, the request is still good, though less pressing than a month ago. The price varies, according to quality, from about 8s. 9d. to 10s. per ton for the usual classes; while for Wear specials, up to 10s. 6d. is the current quotation. The local consumption is better than a year ago. As to contracts, little has been done of late. But some heavy sales are reported for shipment during the season; and of these a considerable portion is for best Durham gas coal at a price said to be from 9s. 6d. to 9s. 7½d. per ton f.o.b. The total quantity thus disposed of is believed to be above 400,000 tons. It is quite possible that other sales will follow, now that some of the coalowners have made the concession in price. As to coke, the market is quiet; and though the production of gas coke is now less, there are still considerable stocks—the price varying from 12s. 6d. to 13s. 3d. per ton f.o.b.

Scotch Coal Trade.

Trade is in an unsettled state, the demurrage question which is in crisis causing serious disturbance, particularly to shipping business. At the present time, foreign buyers are continuing to give a preference in their orders to North of England sellers, where there is no risk of incurring liability for unavoidable detention to waggons. Scotch coal for export is consequently a drug in the market. The home demand is fair. The prices quoted are: Ell 10s. to 10s. 6d. per ton f.o.b. Glasgow, splint 10s. 6d. to 10s. 9d., and steam 10s. to 10s. 3d. The shipments for the week amounted to 264,731 tons—an increase upon the preceding week of 16,816 tons, and upon the corresponding week of 63,460 tons. For the year to date, the total shipments have been 921,449 tons—an increase upon the corresponding period of last year of 33,795 tons.

Anomaly of Preferential Water Charges.—In support of his suggestion for a revision of the water charges, Alderman Snape, at the Salford Town Council meeting last Wednesday, said he knew of one manufacturer in the borough who would have saved £5 by allowing his taps to run. The Alderman explained that the manufacturer in question was charged £5 more for using 900,000 gallons than would have been the case if he had used 1,000,000 gallons. Owing to the late hour at which the subject was introduced, the Council adjourned the discussion until the next meeting.

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GLASGOW.

Price of Gas for Power at Manchester.

At last Wednesday's meeting of the Manchester City Council, Mr. Jennison asked for the name of a certain firm to whom the Gas Committee had decided to grant a reduction in the price of gas used for manufacturing purposes on the condition that they consumed, for a specific purpose, not less than a million cubic feet per annum. There were many of the citizens deserving of such a concession, he said, and particularly users of penny-in-the-slot meters. If the Committee intended to make any reduction, they should begin with these people. Alderman Gibson, after speaking of the competition with which the Gas Committee had now to deal, said some time ago it was decided to make a reduction in the price of gas used for power purposes. It was determined to grant a concession of 3d. per 1000 cubic feet in respect of gas-engines. This proposal brought a sort of hornets' nest about the ears of the Committee; and it had now been resolved to give due consideration to any reasonable application. The firm in question were large consumers, and were at present using about 7 million cubic feet per annum. They desired to utilize gas for the purpose of melting lead; and on condition that they used a million cubic feet for this, the price had been reduced to 2s. per 1000 cubic feet.

Theft of Mantles from the Winchester Gas Company.—Before the Winchester City Bench last week, William Pritchard, maintainer, and Frederick Mitchell, lamplighter, employed by the Winchester Water and Gas Company, were charged with the theft of two dozen gas-mantles, value 8s., belonging to the Company, on Jan. 2 and 16. They pleaded guilty. The mantles were stamped "Winchester Water and Gas Company;" and their name was also on the box, in addition to the words, "Not to be sold." The mantles were for the public lamps, and were obtained from the stores, ostensibly for the purpose of being placed on the lamps. Some, however, were afterwards disposed of to people in the town. Pritchard, who said Mitchell was the tempter, had an exemplary character for twelve years' service in the army, and also for five-and-a-half years' service with the Company. He was fined £3 and 14s. costs, and Mitchell £5 and 14s. costs.

Suicide by Coal Gas in London.—In the City Coroner's Court last Wednesday, Dr. F. J. Waldo held an inquiry with reference to the death of William Robert Julius Kaufmann, aged 35, who committed suicide by inhaling coal gas, at the Three Nuns Hotel, Aldgate, on the previous Saturday. The deceased was a native of Hamburg, and came to London three weeks ago to represent a firm of shipbuilders. He had, however, led rather a loose life, and had got into financial difficulties. Money for which he had written not arriving, he became despondent; and he took his life in the way stated. Dr. Sequira, who gave evidence at the inquest, stated that on trying artificial respiration he forced gas out of the lungs of the deceased at each pressure; so that he must have inhaled a great quantity. It was a case of poisoning by carbon monoxide. The Jury returned a verdict of "Suicide," without expressing any view as to the state of mind of the deceased.

Effect of Trade Depression on Gas Consumption.

At the last meeting of the Stockton Town Council, the Gas Manager (Mr. William Ford) reported a slight improvement in the gas consumption compared with the many adverse reductions which had taken place during the past twelve months. The make of gas in December was 44,422,000 cubic feet, against 47,871,000 cubic feet in the corresponding month of 1907; showing a decrease of 3,449,000 cubic feet, or 7·20 per cent.—the decrease in consumption being 3·26 per cent. Alderman J. Harrison, the Chairman of the Gas Committee, said he was sorry the decrease in the consumption of gas continued. During the nine months of the financial year which had expired, the undertaking had not turned out so satisfactorily as they had expected. He hoped, therefore, that, when the end of the year came, members would not expect the Committee to show so favourable a balance-sheet as was anticipated twelve months ago. They had passed through a period of great depression in trade; several of the works in which gas was consumed having been closed, wholly or partly, during the time. In the circumstances, it was hardly to be expected that the undertaking could show its usual large margin of profit.

Two Gas Suicides at Hunslet.—Two inquests were held last week, on the same day, at Hunslet, Leeds, at which the Juries returned the verdict of "Suicide during temporary insanity." In both cases, a rubber tube fastened to a gas-bracket, from which gas was inhaled, was the cause of death. Bad trade and ill-health were the reasons assigned for the tragedies.

Carlisle Gas Stokers and Sunday Duty.—At a meeting of the Gas Committee last Wednesday evening, a resolution of the Town Council to do away with the Sunday duties of the stokers was considered. The Engineer (Mr. W. J. Smith) submitted a report, in which he pointed out that it would be impossible to carry on the works without Sunday stoking, except at great risk of inefficiency and loss; and he recommended that in future the work be done by labourers from the yard, employed six days a week. The recommendation was adopted.

The Proposed Gas Amalgamation at West Ham.—At the last meeting of the West Ham and District Trades and Labour Council, the following resolution was passed, after some discussion: "That this Council protests against the amalgamation of the West Ham Gas Company and the Gaslight and Coke Company, because it will mean the throwing out of employment of hundreds of men at present employed by the West Ham Gas Company, and the placing of the gas consumer at the mercy of a monopoly that is already too strong. Further, that this Council urges upon the Local Authorities in the districts affected the necessity for opposing the amalgamation, and asks the Members of Parliament for West Ham (N. and S.), Romford, and Walthamstow to do all in their power to prevent it." Another resolution was passed asking the West Ham Town Council to oppose the scheme, and also to endeavour to purchase the West Ham Gas-Works.

Gas Plant and all constructional Steel and Iron Work.

Specialists in Slot Meters, Ordinary Meters, Wet & Dry.

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The Pioneers of Slot Installations.

Gas Fittings.

Gas Fires.

Gas Cookers.

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Gas Poisoning Case at Lincoln.—A verdict of "Accidental death" was returned by the Coroner's Jury who inquired into a Lincoln fatality of which William Williamson, aged 79, a retired master mariner, was the victim. Deceased was found in bed with a gas-bracket tap turned on a little, and gas escaping. His grand-daughter stated that he used the gas each night; and that of late his hand had been very shaky.

Failure of Gas at Long Sutton.—It is reported that, owing to a mishap at the Long Sutton (Lincs.) Gas-Works, the town was without gas on the night of last Saturday week, and for some time on Sunday; and all gas consumers in the shops, inns, and private houses had to have recourse to paraffin lamps and candles. A pantomime was being run at the Exchange Hall; and in order that the performance might proceed, a supply of lamps had to be obtained.

New Companies Registered.—The Gas Light and Power Syndicate, Limited, has been registered with a capital of £10,000, in £1 shares, of which 5000 are preference, to acquire the sole rights and interests, except those for the United States, in certain improvements in the manufacture of combustible, smokeless, and odourless gas, and in apparatus therefor. The South of England Natural Gas and Petroleum Company, Limited, with a capital of £20,000, in £1 shares, of which 10,000 are 8 per cent. preference, propose to carry on at Heathfield, Sussex, and elsewhere, the business of natural or coal or other gas works proprietors, petroleum refiners, &c.

Position of the Kingsclere Gas-Works.—The annual meeting of the shareholders of the Kingsclere Gas Company was held on Monday of last week—Mr. E. Wilson, of Salisbury, Chairman of the Company, presiding. The accounts, which showed a balance of £2 19s. 10d. for the year ending Dec. 31, were adopted. Attention was called to the complaints made by consumers of the foul condition of the gas; and it was stated that Mr. W. Higgs, Manager of the Basingstoke Gas Company, had overhauled the gasholder, &c., and had submitted a report. The Chairman proposed that a special meeting be held to consider the advisability of disposing of the works by sale or otherwise.

Automatic Gas Lighting at Carlisle.—It is reported in the local Press that a meeting of the Gas and Lighting Joint Sub-Committee was held last week to consider the complaints which have been made as to the unsatisfactory working of the automatic gas-lighting apparatus now in use. A letter was read from the British and Colonial Automatic Lighting Company offering to light a series of 250 lamps, keep them in repair, cleaned and regulated, and guarantee their accuracy, for the sum of 14s. per annum per single burner and 17s. for a double burner. The letter further stated that if the offer mentioned were accepted the Company would employ a man to see that the apparatus was kept in perfect working order. The Committee decided to accept the Company's offer for a period of twelve months, subject to an agreement being entered into.

Bursting of a Water-Main at Putney.—By the bursting of a 24-inch water-main below the roadway at the foot of Putney Bridge last Tuesday morning, a great volume of water poured down Putney High Street, causing much damage to property. Soon after nine o'clock, with a loud report, the wood paving in front of the White Lion Hotel began to rise; and in an incredibly short time the whole mass of blocks for a distance of 100 yards was floating in water from 3 to 4 feet in depth. A motor omnibus bound for the City essayed to cross, but came to a standstill midway. The passengers crowded the roof to escape the water, which soon reached the flooring. After waiting about 30 minutes, they were rescued by means of a bridge constructed of stout planks. Two skiffs from a neighbouring boathouse were launched, and rendered service to imprisoned householders. The cause of the accident is stated to have been the breaking of the pipe at a joint. A gang of men were soon on the scene repairing the damage; while the Tooting, Wandsworth, and Fulham fire-engines pumped the water out of the several basements.

South Staffordshire Mond Gas Power and Heating Company.—The report of the Directors of this Company for the past year sets forth that during this period the number of ordinary customers on the books increased from 69 to 84, and the number supplied from 56 to 80. A branch main is being laid to open up another portion of the Walsall district. There has been a continued improvement in the working of the plant and the recovery of bye-products. The proportion of gas sold to ordinary customers was 60 per cent. more than in 1907; and the average price realized shows an increase of 40 per cent. The loss on revenue account is £4850, or £7275 less than last year. The loss has been regularly reduced month by month, and in December was only one-seventh of that in January, 1908. The Directors consider this progress very satisfactory, especially in view of the general depression in trade. The Directors regret the death of Colonel J. B. Cochrane, who was a Director from the formation of the Company, and Chairman from 1903 to 1905. It is not intended at present to fill the vacancy on the Board. The Directors have again decided to forego their fees and travelling expenses for the year.

Danger of Obsolete Chandeliers.—At Lambeth last Tuesday, Mr. Troutbeck held an inquest on the body of Alice Jane Sturt, aged 42, wife of a commercial traveller now an inmate of Claybury Asylum, lately residing at Tremadoc Road, Clapham, who died in St. Thomas's Hospital on the 31st ult. from the effects of injuries caused by a gas explosion. The evidence showed that on the evening of the 19th ult. Mrs. Sturt detected an escape of gas in the front parlour, and opened the windows. A little later there was an explosion, and she was found to have been severely burnt. There was in the room a gas-chandelier with a water-slide, and just before Christmas the occupiers of the house were advised to have it exchanged; but they were not sure to whom it belonged. Mrs. Sturt stated that she had got on the table to light the gas, when the explosion occurred, and she was thrown to the floor. Water had been supplied to the chandelier three days before. The premises were severely damaged by the explosion. James Moore, foreman fitter in the service of the South Metropolitan Gas Company, said the explosion was the result of water having evaporated from the chandelier, which was of an obsolete type. The Company were trying their utmost to induce their customers to cease using such chandeliers. The Jury returned a verdict of "Accidental death."

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GAS FIRES
OF
Exceptional Merit and Value.

ARTISTIC DESIGNS. NOVEL FEATURES.

The "ELIZABETHAN" Style.

Made in 3 Sizes, as follows:—

Nos. 3216.	3217.	3218.	
8	10 and	12 inches	Fire Opening.
24½	27 "	31 "	High over all.
18½	21½ "	23 "	Wide "

PRICE FROM **22s.** EACH.

The "ADAMS" Style.

The "NEW" Style.

Made in 3 Sizes, as follows:—

Nos. 3210.	3211.	3212.	3213.	3214.	3215.	
8	10	12 ins.	8	10	12 ins.	Fire Opening.
24½	27	31 "	24½	27	31 "	High.
18	20	21½ "	17½	19½	22 "	Wide.

PRICE FROM **22s.** EACH.

Manufacturers:

CANNON IRON FOUNDRIES, Ld.,

DEEPFIELDS, near Bilston, Staffs., Eng.

London Office and Show-Rooms:

18, HOLBORN VIADUCT, E.C.

Australasian Agents:

JAMES HURLL & CO., Ltd., 20, Loftus Street, SYDNEY,

and Box No. 4 (G.P.O.) Dunedin.

Grantham Water Bill.—In moving that the shareholders should approve of the Bill which is now being promoted by the Grantham Water Company, the Chairman (Mr. J. G. Thompson, J.P.) gave a history of the water-works from their inception in 1850, at which time the water was drawn only from Stroxton. Owing to the growth of the town, he said, they had from time to time taken in other sources of supply, until in 1873 they promoted a Bill which placed them on the footing which they occupied at the present time. Since that date, Grantham had grown enormously; and during the last twenty years the consumption of water had increased from 212 million gallons a year to 312 millions. During the same period, the number of houses supplied in Grantham had grown from 2700 to 4170; and therefore the proprietors would not be surprised to hear that they had to extend their works. They had expended a large sum on capital account, which had been met by the balance on revenue account and from premiums on shares—the amount being £17,000. Now they were asking permission to raise £40,000 more capital, which would repay the borrowed capital and provide for the future so far as Parliament would allow—viz., a period of twenty years. He thought the Bill would be of benefit, not only to the shareholders, but to the consumers; and the Company recognized that it was their primary duty to supply good water to the town.

According to the "Financial News," the erection of gas-works will shortly be commenced in the town of Helsingfors, Finland, and it is expected that the contract will be completed next year.

The "Daily Express" says the Coalite Company are exhibiting at London Wall Buildings an assortment of "Coalite" fires which, by the application of an inexpensive solution, are made to give out delicately coloured flames of green, blue, and heliotrope—in fact, all the hues of a rainbow or a peacock's tail.

A resolution has been carried by the Silloth Ratepayers' Association in favour of the purchase of the local gas-works, if suitable terms can be arranged. As, however, the present charge for gas is 5s. 8d. per 1000 cubic feet, the Committee of the Association were requested to petition for a reduction in price pending the arrangement of these "suitable terms."

By 54 votes to 28, the Manchester City Council last Wednesday rejected a resolution moved by Mr. Swales to the effect that, in view of the heavy financial calls on the citizens and the probable increase in the rates, no advances in salary be granted to those officials receiving between 25s. and 63s. weekly. The advances recommended by the Gas Committee to officials in the department (published in last week's "JOURNAL") will come before the March meeting of the Council.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER. Dalkeith Gas Company. Applications by Feb. 20.
OUTDOOR SUPERINTENDENT. Waterford Gas-Works.
SALESWOMAN. Hawick Gas Company.
TRAVELLER (COAL). No. 5049.

Situations, &c., Wanted.

ASSISTANT-MANAGER. E. Sainter, Gas-Works, Longwood.
DIVING (SURVEYING OR CONSTRUCTIONAL). Lambert, Kennington.
MANAGER, OR MANAGER AND SECRERARY. No. 5056.
MANAGER AND SECRETARY. No. 5055.
RETORT SETTERS. No. 5053.
WORKING MANAGER. No. 5054.

Plant, &c. (Second-Hand), for Sale.

GASHOLDER, &c. Wallingford Gas-Works.
STATION METERS Laidlaw and Sons (Edinburgh). Limited.
STATION METER. No. 5057.

Plant, &c. (Second-Hand), Wanted.

LAMP COLUMNS AND LANTERNS. No. 5057.
PHOTOMETER. Centenary Gas Company.

Meetings.

BARNET GAS AND WATER COMPANY. Holborn Restaurant. Feb. 26. 12.30 o'clock.
BRENTFORD GAS COMPANY. St. Ermin's Hotel. Feb. 12. 2.30 o'clock.
BROMLEY AND CRAYS GAS COMPANY. Bell Hotel, Bromley. Feb. 24. Six o'clock.
CHICHESTER GAS COMPANY. Gas-Works. Feb. 25. One o'clock.
HARROW AND STANMORE GAS COMPANY. Holborn Restaurant. Mar. 1. Twelve o'clock.
HORNSEY GAS COMPANY. London Office. Feb. 19. 3.30 o'clock.
MITCHAM AND WIMBLEDON GAS COMPANY. Offices. Feb. 23. Three o'clock.
NORTH MIDDLESEX GAS COMPANY. London Office. Feb. 24. 2.30 o'clock.
RIDDINGS GAS COMPANY. London Office. Feb. 26. 3.30 o'clock.
SOUTHGATE GAS COMPANY. London Office. Feb. 18. 3.45 o'clock.
SOUTH SUBURBAN GAS COMPANY. De Keyser's Royal Hotel. Feb. 19. Three o'clock.
UXBRIDGE GAS COMPANY. Offices. Feb. 25. 2.30 o'clock.

Stocks and Shares.

ALDERSHOT GAS AND WATER COMPANY. Feb. 23.
HARROW AND STANMORE GAS COMPANY. Feb. 25.
HERTS AND ESSEX WATER COMPANY. Feb. 23.
SOUTH ESSEX WATER COMPANY. Mar. 2.
SOUTH-WEST SUBURBAN WATER COMPANY. Feb. 23.
SUNDERLAND AND SOUTH SHIELDS WATER COMPANY. Feb. 18.

TENDERS FOR

Benzol.
BRIDGEWATER COLLIERIES COKE WORKS. Tenders by Feb. 12.

Exhauster, Boiler, and Engine.
NORTH ORMESBY GAS COMPANY. Tenders by Mar. 4.

Fire-Clay Goods.
BRITON FERRY GAS DEPARTMENT. Tenders by Feb. 23
TODMORDEN GAS DEPARTMENT.

Purifiers.
ULVERSTON GAS DEPARTMENT. Tenders by Feb. 25.

Retorts and Setting, &c.
BRITON FERRY GAS DEPARTMENT. Tenders by Feb. 23.
TODMORDEN GAS DEPARTMENT.

Slot Installation Fittings.
LLANDUDNO GAS DEPARTMENT. Tenders by Feb. 27.

Sulphate Plant.
BRIDGEWATER GAS COMPANY. Tenders by March 1.

Sulphuric Acid.
HERNE BAY GAS COMPANY. Tenders by Feb. 15.

Tar.
HAVERFORDWEST TOWN COUNCIL. Tenders by Feb. 16.
HERNE BAY GAS COMPANY. Tenders by Feb. 15.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 366.

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 15	10	Alliance & Dublin 10 p.c.	18¼–19	..	5 5 3
268,324	10	,,	7	Do. 7 p.c.	12½–13¾	..	5 5 8
310,000	Stk.	Jan. 14	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
200,000	5	Oct. 29	6½	Bombay, Ltd.	5⅝–5¾	..	5 10 8
40,000	5	,,	6½	Do. New. £4 paid	3⅝–4⅛	..	6 6 1
50,000	10	Aug. 27	14	Bourne-mouth Gas & Water } 10 p.c. B 7 p.c. Pref. 6 p.c.	29–30	..	4 13 4
51,810	10	,,	7		16¼–17	..	4 2 4
53,200	10	,,	6		15½–16½	..	3 13 10
380,000	Stk.	Aug. 13	12½	Brentford Consolidated	248–251	+1	4 19 7
200,000	,,	,,	9½	Do. New	188–191	+1	4 19 6
50,000	,,	,,	5	Do. 5 p.c. Pref.	122–124	..	4 0 8
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	101–103	..	3 17 8
220,000	Stk.	Sep. 11	10½	Brighton & Hove Orig.	214–217	..	4 19 1
246,320	,,	,,	7½	Do. A Ord. Stk.	153–156	..	4 19 4
460,000	20	Oct. 15	10	British	42½–43½	..	4 11 11
109,000	Stk.	Aug. 27	6	Bromley, Ord. 5 p.c.	115–117	+1	5 2 7
165,700	,,	,,	4½	Do. do. 3½ p.c.	84–86	..	5 4 8
500,000	10	Oct. 15	7	Buenos Ayres (New) Ltd.	12–12½	..	5 12 0
250,000	Stk.	Dec. 11	4	Do. 4 p.c. Deb.	93–95	..	4 4 3
150,000	20	July 15	7½	Cagliari. Ltd.	25⅞–26½	..	5 9 5
103,000	10	—	—	Cape Town & Dis., Ltd.	4½–5¼	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c. Pref.	8½–5¼	..	8 3 8
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	47–49	..	6 2 5
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	76–78	..	5 15 5
157 150	Stk.	Aug. 13	5	Chester 5 p.c. Ord.	111½–113½	..	4 8 1
1,193,280	Stk.	Aug. 27	5⅝	Commercial 4 p.c. Stk.	107–109	..	4 15 5
560,000	,,	,,	5	Do. 3½ p.c. do.	103–105	..	4 15 3
475,000	,,	Dec. 11	3	Do. 3 p.c. Deb. Stk.	81–83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	101–103	..	6 6 3
200,000	,,	,,	7	Do. 7 p.c. Pref.	137–140	..	5 0 0
467,170	Stk.	,,	5	Derby Con. Stk.	122–124	..	4 0 8
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
143,995	,,	Sep. 30	5	East Hull 5 p.c. Ord.	98–100	..	5 0 0
486,090	10	Jan. 28	12	European, Ltd.	23½–24*	..	5 0 0
354,060	10	,,	12	Do. £7 10s. paid.	17½–18*	..	5 0 0
15,161,545	Stk.	Aug 13	4/10/8	Gas light and Coke } 4 p.c. Ord.	102½–103½	..	4 7 6
2,620,000	,,	,,	3½		89½–90½	..	3 17 4
3,797,735	,,	,,	4		106½–107½	..	3 14 5
4,193,975	,,	Dec. 11	3		84½–85½	..	3 10 2
258,740	Stk.	Sep. 11	4½	Hastings & St. L. 3½ p.c.	95–97	..	4 17 11
82,530	,,	,,	6½	Do. do. 5 p.c.	113–115	..	5 8 8
70,000	10	Oct. 15	11	Hongkong & China. Ltd.	18–18½	..	5 18 11
123,570	Stk.	Sep. 11	6½	Ilford "A" and "C"	132–134	..	4 17 0
65,780	,,	,,	5	Do. "B"	104–106	..	4 14 4
51,000	,,	Dec. 30	4	Do. 4 p.c. Deb.	102–104	..	3 16 11
4,949,000	Stk.	Nov. 13	8	Imperial Continental	179–181	..	4 8 5
473,600	Stk.	Aug. 13	3½	Do. 3½ p.c. Deb. Red.	95–97	..	3 12 2
195,242	Stk.	Aug. 27	6	Lea Bridge Ord. 5 p.c.	120–122	..	4 18 4

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 27	10	Liverpool United A.	232–234	..	4 5 6
718,100	,,	,,	7	Do. B	172–174	..	4 0 6
306 083	,,	Dec. 30	4	Do. Deb. Stk.	105–107	..	3 14 9
55,000	5	Dec. 11	6	Malta & Medn, Ltd	4⅛–4¼	..	6 3 1
550,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	100–102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	Nov. 13	3⅜	Monte Video, Ltd.	11½–12	..	5 16 8
1,775,892	Stk.	July 30	4/12/6	Newc'tle & G't sh'd Con.	110–111	..	4 3 4
418,460	Stk	Dec. 30	3⅜	Do. 3½ p.c. Deb.	91–93	..	3 15 3
15,000	10	Aug. 27	10	North Middl sex 10 p.c.	20–20½	..	4 17 6
55,940	10	,,	7	Do. 7 p.c.	13¾–14	..	5 0 0
303,030	Stk.	Nov. 27	8	Oriental, Ltd.	140–142	..	5 12 8
60,000	5	Sept. 30	8	Ottoman, Ltd.	6½–6⅝	..	6 5 6
31,830	53	Aug. 27	13	Portsea Island A.	138–140	..	4 18 6
100,000	50	,,	12	Do. B.	132–134	..	4 17 0
114,800	50	,,	10	Do. C.	122–124	..	4 16 9
398,490	5	Oct. 29	7	Do. D and E.	104–106	..	4 14 4
796,983	5	Jan. 28	5	Primitiva Ord.	6–6½	..	5 14 3
483,900	100	Dec. 1	4	Do. 5 p.c. Pref.	5–5¼*	..	4 15 3
1,200,000	10	Oct. 15	8	Do. 4 p.c. Deb.	95–97	..	4 2 6
312,650	Stk.	Dec. 30	4	River Plate Ord.	13½–14	..	5 14 4
250,000	10	Sept. 30	8	Do. 4 p.c. Deb.	93–95	..	4 4 3
125,020	50	Jan. 2	5	San Paulo, Ltd.	14–14½	+⅛	5 10 4
135,000	Stk.	Sept. 11	10	Do. 5 p.c. Deb.	49–50	..	5 0 0
209,98½	,,	,,	10	Sheffield A	240–242	..	4 2 8
523,520	,,	,,	10	Do. B	240–242	..	4 2 8
70,000	10	Oct. 29	10	Do. C	238–240	..	4 3 4
6,429,895	Stk.	Aug. 13	5/6/8	South Afr can	13½–14	..	7 2 10
1,895,445	,,	Jan. 14	3	South Met., 4 p.c. Ord.	121–123	..	4 6 8
209,820	Stk	Aug. 31	8	Do. 3 p.c. Deb.	84–85	..	3 10 7
605,000	Stk.	Aug. 13	5/6/8	South Shields Co., Stk.	153–155	..	5 3 3
60,000	,,	,,	5	S'th Suburb'n Ord. 5 p.c.	119–121	..	4 8 1
117,058	,,	Jan. 14	5	Do. 5 p.c. Pref.	121–123	..	4 1 4
502,310	Stk.	Nov. 13	5	Do. 5 p.c. Deb. Stk.	122–124	..	4 0 8
120,020	Stk.	Aug. 13	6⅔	Southampton Or's.	107–109	..	4 11 9
398,940	,,	,,	5½	Tottenham and Edmonton } A 5 p.c. B 3½ p.c. 4 p.c. Deb.	134–136	..	4 19 3
149,470	,,	Dec. 30	4		106–108	..	4 17 3
182,380	10	,,	8		100–102	..	3 18 5
149,900	10	Jan. ,,	5	Tuscan, Ltd.	8⅞–9¼	..	8 13 0
193,742	Stk.	Aug. 27	5	Do. 5 p.c. Deb. Red.	98–100	..	5 0 0
253,636	Stk.	Aug. 27	6⅔	Tynemouth, 5 p.c. max.	106–108	..	4 12 7
79,416	,,	Dec. 30	3	Wands-worth and Putney } B 3½ p.c. 3 p.c. Deb. Stk.	128–130	..	5 0 0
					72–74	..	4 1 1
835,872	,,	Aug. 27	5⅔	West Ham 5 p.c. Ord.	115–117	+1	4 7 7
210,000	,,	,,	5	Do. 5 p.c. Pref.	124–126	..	3 19 4
253,300	,,	Dec. 30	4	Do. 4 p.c. Deb. Stk.	105–107	..	3 14 9

Prices marked * are "Ex div."

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